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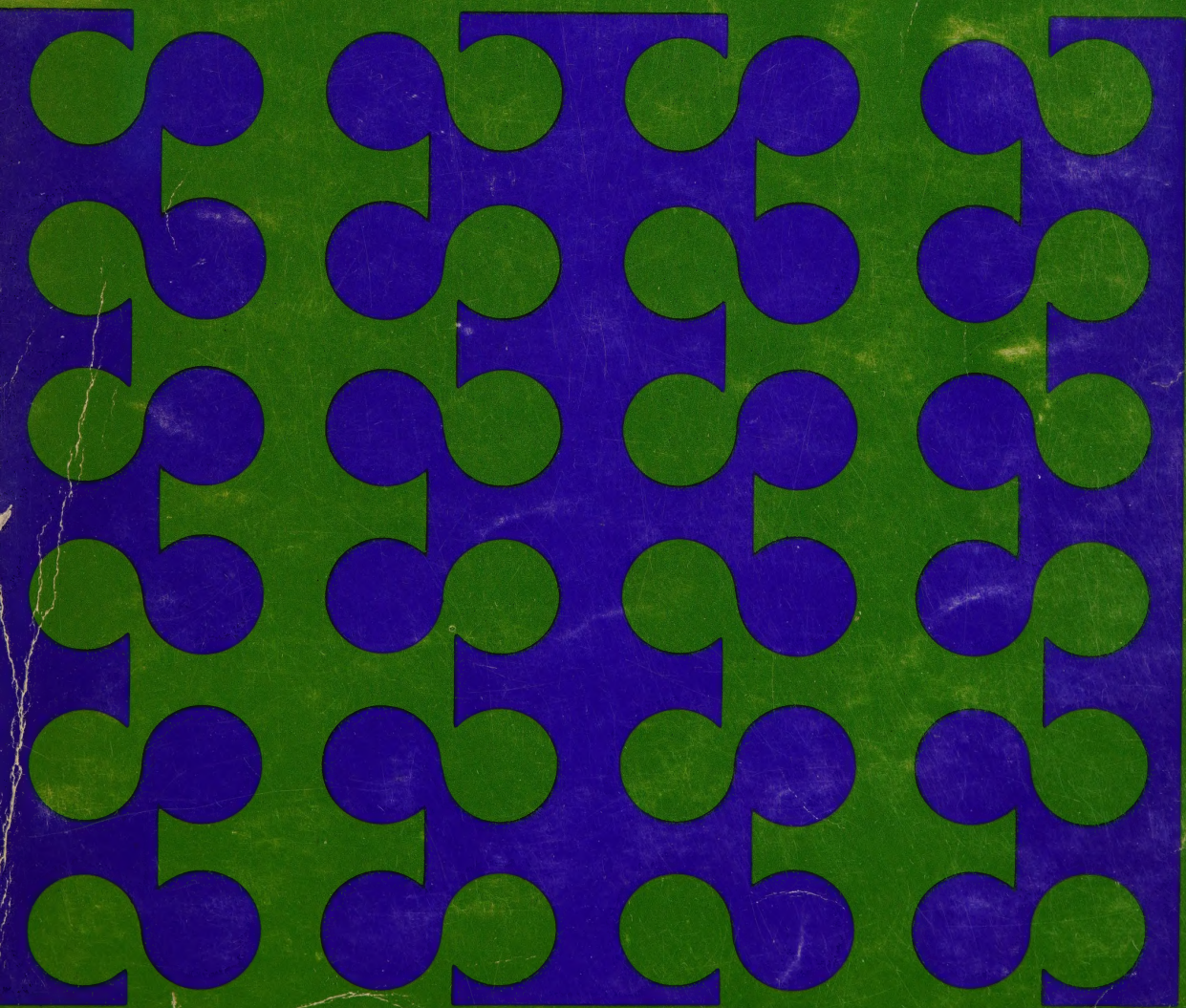
# COST AND BENEFIT STUDY of Post-Secondary Education in Ontario, School Year 1968-69

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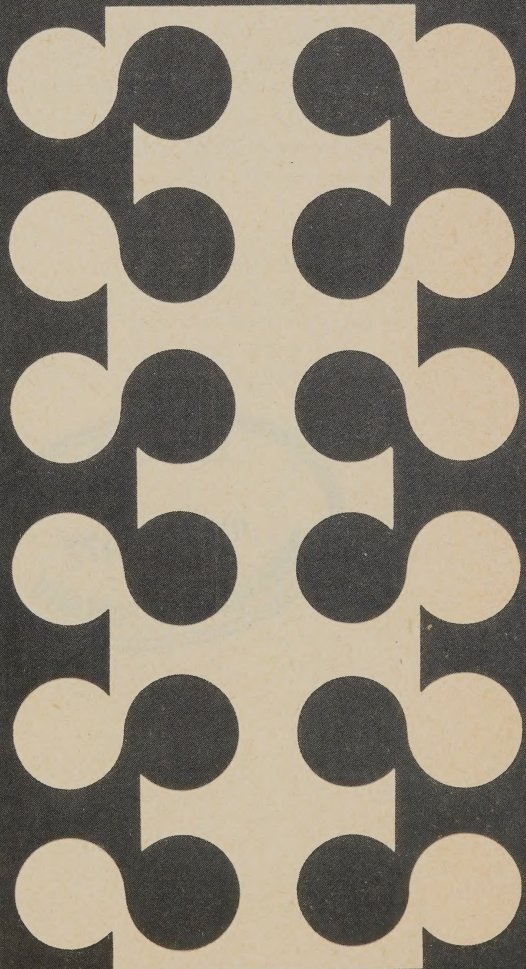
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# COST AND BENEFIT STUDY

of Post-Secondary Education  
in Ontario,  
School Year 1968-69

A Study Prepared for the Commission  
on Post-Secondary Education in Ontario



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of the  
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# Cost and Benefit Study of Post-Secondary Education in Ontario

## Editorial Foreword

The Commission on Post-Secondary Education in Ontario was required by its terms of reference to study and make recommendations on "the pattern necessary to ensure the further effective development of post-secondary education in the Province". The Commission was also required to report on a number of specific problems and issues including: "the costs, allocation of resources and methods of financing for post-secondary education in Ontario as related to the attainment of equality of educational opportunity and as related to the resources of the Province."

It is obvious that information concerning costs and benefits must have a great influence on decision-making related to the financing of higher education and to educational planning generally. It seemed equally obvious that a fresh attempt had to be made to compile and analyze all available cost figures (however approximate) for specific programs, and to assess the corresponding benefits.

Accordingly, the Commission on Post-Secondary Education gave early priority to the preparation of a thorough Cost and Benefit Study of higher education in Ontario.

The purpose of this study is to construct a model for the analysis of the costs of post-secondary education, the benefits arising from post-secondary education, and the effects of post-secondary education on the distribution of wealth in Ontario. The analysis of these costs, benefits, and distributional effects is so complex and controversial that the need for an objective, quantifiable approach is self-evident. But, at the same time, the limitations of such an approach must also be recognized.

Some of the limitations to which an "economic" analysis of post-secondary education is subject are conceptual in nature: how, for example, can we develop measures of the private benefits that accrue to a person from something as diverse and subjective as the experience of "higher education"? Many of these conceptual problems are identified in the Cost and Benefit Study itself and, more fully, in another paper prepared for the Commission on "The Economics of Education".

Perhaps more critically we are aware that analyses of costs and benefits provide evidence on only one scale—dollars—whereas individual and collective decisions of individuals and of government necessarily reflect other measures of cost and benefit. The Commission had hoped to develop a parallel study to examine the non-pecuniary costs and benefits of education as they would relate to creativity and innovation, social mobility, the state of culture, the quality of the physical environment, and public order. Although the importance of measures of such factors, commonly termed "social indicators" is increasingly acknowledged, the entire subject is new enough that measures are still difficult. The Commission's efforts and concerns with respect to social accounting and educational policy will be presented in a separate "background study".

Lest the lay reader be overwhelmed or misled by the magnitude of the total cost figures dealt with in this study, it should be borne in mind that expenditures on higher education in Ontario constitute only a small fraction of Gross Provincial Product—2.1 per cent of GPP in 1971-72. This point is dealt with in the Commission's *Draft Report*, particularly in Table D-15, where total expenditures on

post-secondary education are set out in terms of per-capita costs and as a percentage of Gross Provincial Product.

The costs and benefits of post-secondary education are certain to change as our educational institutions and policies change. Consequently there cannot be a "once and for all" identification of them, but rather some provision must be made for monitoring them over time. Thus, one of the purposes of this study has been to establish a general model whereby such a process may be carried out. Some of the alternative sets of practical arrangements for distributing the costs of post-secondary education which could be envisioned for Ontario are described and assessed in the background study "Financing Post-Secondary Education in Ontario". The Cost and Benefit Study itself is confined to analyzing the existing arrangements.

The principal difficulty encountered in carrying out even this limited exercise was the lack of adequate data. In particular, it proved impossible to obtain useful data on the costs of specific programs of study in the institutions concerned. Faced with this situation, the authors had to fall back on making certain assumptions in order to proceed with a demonstration of how the analysis could be applied to a real situation. As they are careful to point out, these assumptions are not satisfactory substitutes for the actual figures required. This is particularly clear in the case of the assumption that the "formula weights", which reflect the overall costs of operating the provincially assisted universities, can be used as indicators of the costs of the *educational* services these institutions provide. Because of the unrealistic or untested nature of these assumptions, the actual results of this study must be interpreted with caution. Different assumptions would lead to quite different results. A brief review of the general conclusions which may be drawn from the study will be found in Chapter 5.

By demonstrating the feasibility of this approach to educational planning, by establishing the limits within which such an approach may be reasonably expected to be fruitful, and by providing a first approximation to the costs and benefits of post-secondary education in Ontario, the authors of the present study have made a major contribution, not only to the work of the Commission, but to the state of knowledge in the field of social policy formation in general.

The Cost and Benefit Study was carried out by the Systems Research Group of Toronto in close consultation with the Research Committee of the Commission. SRG specializes in the development of scientific techniques to problems of planning and management in the public sector. The organization has been heavily involved in the development and application of computer-based simulation models and information systems for education and health institutions in Canada and the United States, and in the establishment of planning, programming and budgeting systems for a number of public authorities.

This study was submitted to the Commission in April, 1971. The opinions and conclusions contained in the study are solely those of the authors. Publication of this study does not necessarily mean that the opinions and conclusions contained therein are endorsed by the Commission.

COST AND BENEFIT STUDY  
OF POST-SECONDARY EDUCATION IN THE PROVINCE OF ONTARIO  
School Year 1968-69.

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PHASE 1-A

VOLUME 1

The research reported here was funded by the Commission on Post-Secondary Education of Ontario as part of its research program. The work was produced by the Systems Research Group under the direction of Professor R.W. Judy.

APRIL, 1971



## PREFACE

It is obvious that simple economic considerations do not always or alone determine choices. One may decide to go to college because it is fun, or one may select a major course of study because his girl friend is in it. Some go to college because they have nothing else to do or because they want to impress their friends or please their families. Going to college may be seen as "conspicuous consumption" by an anthropologist. We may decide to spend public money on colleges and universities for reasons of social justice, the salvation of souls, human kindness or mercy - or to keep young men and women out of the job market, or to try to stave off violent revolution - or to foment it. In an extreme, academic sense, it may be possible to subject every motivation to "economic" analysis because some kind of value may be ascribed to almost any thing or activity. In a more general sense, however, it does not detract from the value of an economic analysis to admit that the choices of either the learner or of society in supporting post-secondary education may derive from considerations other than obvious - or even subtle - costs which are measurable in dollars.

This report, then, is concerned with the economics of post-secondary education. It deals in quantitative estimates of costs, benefits and redistributive effects of post-secondary education. The units in which our quantities are measured are monetary units - dollars. No one should think that dollars can possibly measure all of the interesting and relevant costs and benefits provided by our educational system. Nevertheless, in reaching private and public policy decisions concerning post-secondary education, better information about the costs, benefits and redistributive effects should be useful. Reason and humility compel us to acknowledge that our estimates of these inevitably

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will be imperfect. It follows that the numbers must be interpreted and used with caution and good judgment. No one should fall into a trap of attributing to numerical estimates a greater significance than can be borne by the analytical approach that has been employed, the assumptions that have been made or the data that have been used. Finally, each man must judge for himself the value of intangible and non-quantified effects.

### ACKNOWLEDGEMENTS

We thank the many people who aided this project by supplying data, offering advice, and, in general, tolerating our many requests. Because the roster of individuals would be quite long, we can list only their agencies: Department of Agriculture, Department of Education, (a) Colleges of Applied Arts & Technology Branch, (b) Teacher Education Branch, Department of Health, Department of Justice, Department of Lands & Forests, Department of Municipal Affairs, Department of Public Works, Department of University Affairs, Ontario Hospital Services Commission, Ontario Institute for Studies in Education.

Many members of SRG participated in this study. Among them were Janet Boyer, John Caffrey, Dave Cook, Mike Kunta, Andy Lester, Paul Little, Lou Perl, John Petch, Fran Van Hartingsveldt, Steve Wilson, Ted Zaharchuk, and Robert Royiwsky, Project Leader and R. W. Judy, Principal.

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## 1. OBJECTIVES OF THE STUDY

This study of the costs and benefits of post-secondary education in Ontario had three rather limited objectives:

- (1) To gather and analyse the data available without troubling individual persons or educational institutions.
- (2) To prepare a preliminary evaluation of the costs and benefits of post-secondary education in Ontario.
- (3) To estimate the probable costs and benefits of further, more detailed, investigations of the subject.

It was recognised that intensive data collection efforts within the various institutions could be launched. The time and resources available for this study, however, precluded this. Furthermore, the results of two intensive studies had not been published at the time the present enquiry was conducted and it seemed prudent to await their appearance before troubling the institutions with another request for detailed data.<sup>E-132/133</sup> Finally, it seemed prudent to try to extract the maximum information from the available data and to assess the responsiveness of policy making process to better information before preceeding with what might be a costly data gathering exercise. As in most other things, the investment of resources in studies of this kind yield diminishing returns after some point; we need some idea of where that point may be before committing large sums to further data gathering and research.

An implicit objective of this study is to focus the attention of a concerned community on certain important aspects of the Ontario post-secondary educational system. Nothing is sacrosanct about the analysis or the results presented in this report. If they raise the level of discussion and debate

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E-132 Ring of Iron, A Study of Engineering in Ontario, Committee Of Presidents of Universities of Ontario, Toronto, 1970.

E-133 An Exploratory Cost Analysis of Some Canadian Universities, Association of Universities and Colleges of Canada, Ottawa, 1970.

about the future of post-secondary education in Ontario, and if they stimulate new and better studies of the problem, an important objective will have been achieved.

### 1.1 Focus of the Study

An axiom of this study is that individuals and society have limited resources with which to try to achieve their ends. However affluent our society is, or may become, we will face the necessity of allocating our scarce resources among the alternative ways available to attain our goals. Economics is the science of rational choice, and this study focuses upon the economics of post-secondary education.

#### 1.1.1 The Necessity for Decision

For each prospective or active student, two fundamental questions are continually posed:

- 1) Should he begin or continue his post-secondary education?
- 2) If he is to begin or continue, which program or course of study should he pursue?

In our society, the individual and his family have the basic responsibility for answering these questions. In doing so, they should weigh at least two kinds of benefits or returns that may accrue to the individual receiving the education. The first and most obvious is the enhanced employment and earnings opportunities that may open up because of the education. Less obvious, perhaps, is the choice of life styles that is implied by a particular decision concerning further education. The returns here cannot be measured entirely in terms of monetary rewards

or job functions; they fall in part into the realm of "psychic" benefits which accrue principally to the individual. Juxtaposing these benefits are the anticipated costs of beginning or continuing a particular line of education. Explicitly or implicitly, a weighing of these costs and benefits influences the decision made.

Society, through its government, is faced with decisions concerning similar questions:

- 1) Which public programs should be mounted?
- 2) What level of financial and other support should be given to each of the various programs?

There is a multitude of competing candidates for public support and each has its insistent champions. But taxpayers cannot be taxed without limit.

Public resources should be allocated among alternative programs so as to produce the best overall return. Public decision makers need information about the probable costs and benefits to society of the various programs; they need information about the distribution of those costs and benefits among various groups in society.

The choice is inescapable. As a society and as individuals we will never have enough resources to do all the things that we might wish to do. We must allocate our resources wisely among the alternative ends that we seek. This report focuses on the pecuniary costs, benefits and redistributions of wealth that occur within the Ontario post-secondary education system.

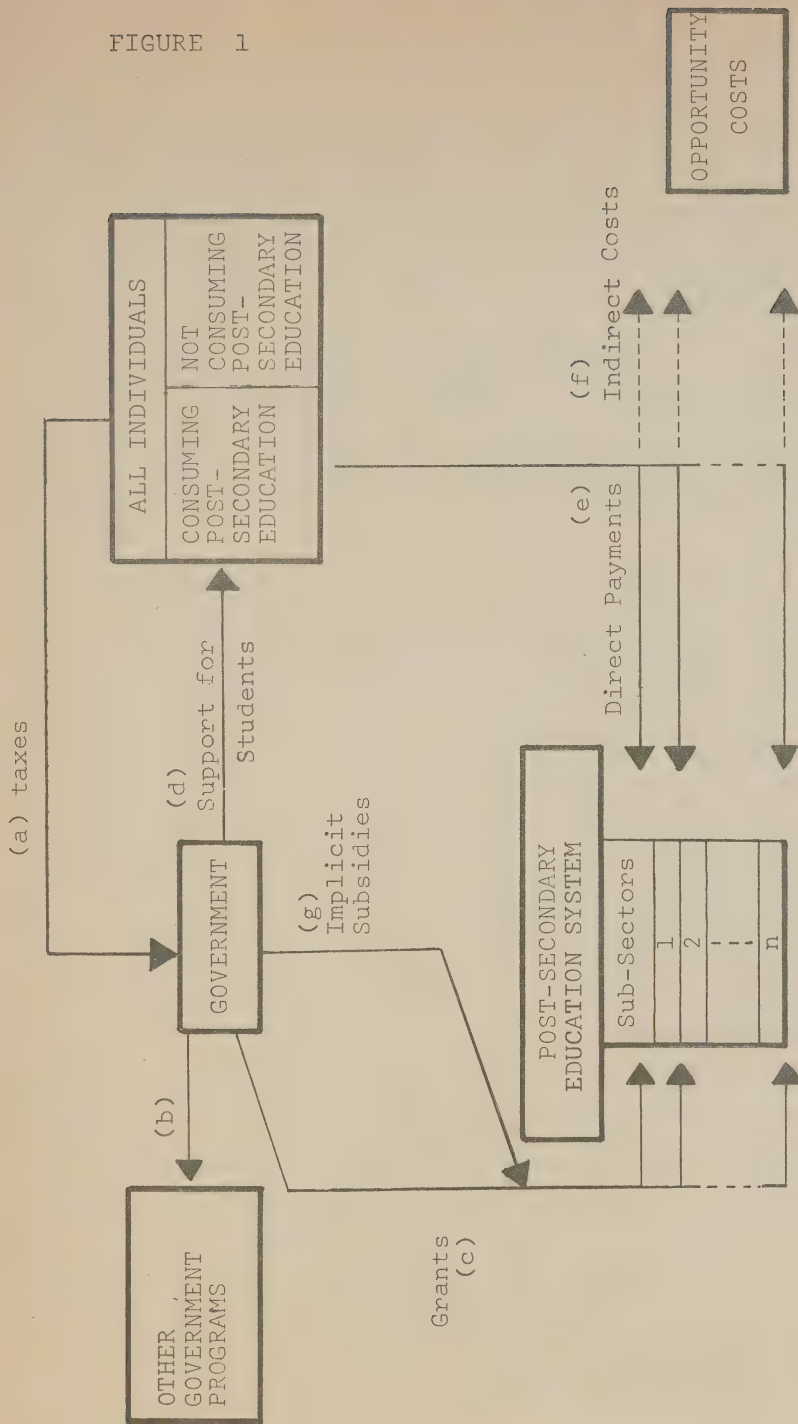
### 1.1.2 Post-Secondary Education as an Economic Activity

As is the case in most other activities in a market economy, the scope and the character of the post-secondary education system are determined or affected by many units which may exercise decision making prerogatives. The various arrows in Figure 1 illustrate some of the alternative choices and flows of financial support associated with the post-secondary education system in Ontario.

Through the taxation system (a) individuals and groups, whether or not they receive post-secondary education, contribute taxes to the various levels of government. Some government expenditures support other programs (b). Other government funds flow directly to institutions within the post-secondary education system (c). This system is divided into several sub-sectors, e.g., the universities, the colleges of applied arts and technology, the schools of nursing. Some government expenditures go directly, in the form of grants or loans, to support students (d). The government must decide upon the allocation of its available resources among the post-secondary education system, support for students and other government programs.

Individuals contribute indirectly to the post-secondary education system via the government budget. They also contribute directly in the form of tuition fees and other direct payments (e). Individuals receiving education incur costs which they would not incur were they not participating in educational programs (f). These indirect costs

FIGURE 1



include expenditures for books, scholastic supplies, etc. In addition, the typical student enrolled in a post-secondary education course foregoes some income which he might have earned had he not been so occupied.

Individuals and governments, by virtue of their power to allocate resources to alternative activities, including higher education, influence the scope and the structure of the educational system. What factors determine those allocation decisions?

A person receiving post-secondary education may be regarded both as a consumer of, and an investor in, higher education. He may be pursuing his education because it is directly valuable to him; he values the knowledge for its own sake, it brings him into contact with stimulating people, it broadens and raises him culturally, etc. In other words, he may enjoy the benefits of education directly as a consumer. In doing this, he compares the enjoyment derived from education with the joys that he might derive from alternative expenditures of his time and money.

As an investor, individuals may be motivated by the anticipation of enhanced status or money which they think they may earn if they have the higher education. They regard their investment in education as the creation of "human capital" embodied in themselves. Like investment in physical capital, this human capital may bring to its owner a stream of future earnings which determine the value of the investment.

To the extent that he is a rational decision-maker, the individual (or his family) compares the

costs, direct and opportunity, of post-secondary education to its anticipated monetary and non-monetary rewards in order to arrive at an optimal investment and consumption decision. He makes his decision as a free agent, disposing of his own private resources. Conceptually, this is a straightforward decision-making problem. In fact, the decision is complicated and obfuscated by significant unknowns and uncertainties that relate to the real costs and benefits which the person may actually experience.

The government faces a more complicated resource allocation decision because it makes a collective decision affecting many social units. The fundamental problem is to enumerate and to compare the various components of the total social costs and benefits of education. These measurements may be roughly compared with those associated with other public programs that could be supported with the resources to be used by the post-secondary educational programs. The determination of social costs is a tractable undertaking, but the estimation of total social benefits raises thorny conceptual and empirical problems. In any case, it is naive to think that we can compute some simple index of "social profitability" of each program by subtracting total social costs from total social benefits. At the very least, the incidence of those costs and benefits on various social groups will be worthy of consideration.

A model which explicitly compares the monetary benefits and costs of post-secondary education can be a useful tool in the resource allocation process. Supplemented by the values and intuitive judgments of the

public policy maker, such a model can provide important information for social and private investment decisions. It should be remembered, however, that every model that attempts to measure costs and benefits is based upon the combination of abstract concepts and considerations; its usefulness depends upon the appropriateness of the assumptions used, the elements built into its structure and the adequacy of the data associated with it.

## 2. THE ECONOMICS OF EDUCATION: A BRIEF OVERVIEW

The cornerstone of a study of the benefits of education is a body of economic theory called human capital theory. The fundamental proposition of this theory is that new knowledge, gained through various learning processes, resides in the learner as embodied capital. This embodied human capital is thought to have a direct effect on the productivity of labour; through increased productivity it is ultimately reflected in an increase in the wealth of an economy.

Human capital is perceived to have many of the same qualities as physical, reproductive capital in that both are capable of generating a stream of benefits, or monetary returns, over time. Embodied human capital in an individual will be rewarded by income benefits which may be measured as income differentials among groups of individuals who have had more or less schooling. To illustrate, the value of the human capital resulting from an investment in an engineering education could be estimated by computing the net present value of the differential earnings between a sample of graduate engineers and a control sample of high school graduates of similar inherent ability.

The analogy between human and physical capital may be carried farther - for example, the concepts of depreciation and obsolescence may be applied. A major difference between human and physical capital is that the former is less tangible and may be more easily dissipated and unrealised than the latter. Furthermore, because human bondage is proscribed, an individual may not mortgage his human capital in order to obtain the resources necessary to obtain it. This fact underlies what may be an inherent bias on the part of individuals to under-invest in human capital unless subsidized. Another distinction between human and physical capital is that the former depends upon a special set of mental and physical attributes which make it possible to acquire the education, to use it, and to partake of

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its benefits.

Human capital theory is a macro - as opposed to a micro - economic theory. It applies to aggregates and large groups rather than to individuals. Consequently, we may speak of marginal increments in educational investment without being concerned about the difficulty that an individual might experience in making a marginal change in his stock of human capital.

From a social point of view, investment in various forms of human capital may contribute positively to the social good. For example, investment in education or in public or private health facilities may all contribute to the human capital of the society. The returns on these investments, however, may differ markedly. Similarly, investment in different types of education may be expected to generate quite different returns in terms of the streams of income that may be realised. The differentiation will be, in part, based upon the differing demands for specific varieties of highly trained manpower. In 20th century Ontario, for example, a computer scientist may have greater earning power than either a social worker or a priest. It is possible to compare the profitability of educational investment in computer science and religious instruction by comparing the estimated income streams of computer scientists and clergymen.

Although the profitability of investment in different forms of higher education varies (as reflected by the variation of such indices as net present value, benefit-cost ratios or internal rates of return), care must be taken not to exaggerate the significance of this variation. The demand for specific forms of labour is capricious, and there is no reason to believe that one particular type of skill will forever be in high demand. Also, skill substitution combined with some

form of on-the-job training or apprenticeship scheme, may circumvent the need for highly specialised post-secondary educational training. In addition, as we have noted previously, pecuniary indices of the profitability of investment in education are based on quantifiable monetary variables. Yet the society should and does respond to many non-monetary motivations. Individuals may purchase higher education more for consumption than for investment. Because of imperfections in the capital market, the pecuniary benefits of higher education may not be adequately discounted. Finally, a whole set of non-financial values are generated by the post-secondary educational system, and, while these values may contribute to the quality of life in society, they may not be rewarded through the market mechanism. A society devoid of priests, social workers and philosophers may be a society devoid of spirit.

Historians of human capital theory find the origins of the notion in Adam Smith's, Wealth of Nations (1776), wherein the author related the wealth of a society to "learning" and to the productivity of labour. The modern sequel to Adam Smith's conjectures is found in recent studies of the sources of economic growth. In Canada, the most outspoken exposition of education's contribution to economic growth is to be found in the second annual review of the Economic Council of Canada.

On the basis of such calculations which have recently been made, it has been estimated that the rate of returns on the "human investment" in the high school and university education in Canada, are in the range of 15 to 20 percent per year with slightly higher rates for an investment in a university education than in a high school education. Moreover, it might be noted that the above calculations treat all costs of education as investment; if some part of these costs were to be treated as consumption rather than investment, the rates of return would be higher. E-134/

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E-134     Second Annual Review, p. 90, "Toward Sustained and Balanced Economic Growth", Economic Council of Canada, Ottawa, 1965.

The studies of investment in human capital which were performed during the early 1960's on the basis of data applying to the 1950's seemed to indicate very handsome returns to individuals and to society. More recent studies, based on data of the middle and late 1960's engender more skepticism. The last decade has seen a remarkable expansion of the post-secondary educational system everywhere and particularly in Ontario. A much larger proportion of young people now take advantage of post-secondary educational experiences. The costs of formal education have risen alarmingly. It should not be surprising if analysis reveals substantially lower cost ratios than were obtained ten years ago.

Developing the logic for cost analysis is relatively straightforward. What is required is an empirically defined microscopic picture of the flows of funds and other resources among the government, private and post-secondary educational sectors of the economy. These flows must be classified so that it is possible to break out costs along the following dimensions.

#### Private Costs

These are the costs to individuals, including opportunity costs, of attaining a given level of a particular form of higher education. (In this report they are referred to as student costs )

#### Social Costs

These are the costs to society, including opportunity costs, of producing graduates in various sectors of the higher educational system. Social costs, by definition, include private costs, or costs borne by individuals within the system.

Institutional costs represent expenditures by society directly in the educational process (e.g. for schools). They represent the major portion of costs incurred by society and may be decomposed into Yearly Institutional Costs and Institutional Expected Degree Cost. Institutional costs are the institution-specific costs of educating

a student in every level and every sector of the higher educational system. Institutional Expected Degree Costs are the summation, for each institution, of the Institutional Costs amended by the conditional probabilities that a student will pass through all grades and levels of his particular sector and graduate in the minimum time. These are the production costs of graduates.

Given a cost model which contains a comprehensive set of data on the individual, social and private financial commitments which support the higher educational system, the data may be restructured to generate a number of different types of cost estimates. For a benefit/cost ratio the social costs or expected degree costs must be compared to the expected benefits of a particular sector of the higher educational system.

The test of efficacy of the cost model is its comprehensiveness and the accuracy of the data. Care must be taken to avoid double-counting during the calculation of costs, especially in the computation of social costs.

A number of measurement problems arise in the cost analysis. Certain categories of inputs are not traded on markets and are therefore not priced. For example, much of the existing land, buildings and equipment owned by educational institutions are provided at subsidized rates. The true opportunity costs of these inputs should be included in any calculation of educational costs; they should be valued at their "alternative market costs". Other hidden subsidies also exist. These range from the value of municipal services rendered (to the extent that they exceed payments in lieu of taxes) to the opportunity costs associated with income tax collections foregone because of charitable contributions by individuals and corporations to educational institutions.

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There are other hidden, non-priced categories of inputs for which market prices are not available. For example, some students bear psychic costs which are related to the deferment of gratifications and the taxing academic work associated with study. Included in these are the costs of prolonged adolescence which is often observed in students long in an atmosphere of ego-deprivation. Obviously, these psychic costs are difficult to measure and are not included here.

The cost model provides statistics that are intrinsically interesting. The private costs of education in different sub-sectors of the higher educational system indicate the financial contribution of students to their own education. The social cost statistics, on the other hand, indicate society's commitment to the various types of post-secondary education. The Expected Degree Cost statistics show the cost of producing graduates. These three cost statistics may be juxtaposed to show the proportion of the burden borne by society and by the recipients of the education. The cost figures may be broken out to show the social commitment to higher education in terms of (1) direct costs funneled through institutions of higher learning, and (2) indirect costs and foregone earnings.

After the costs of higher education have been calculated and rendered into their proper components, they may be compared with measures of the benefits of higher education. The benefit-cost ratio is a framework for making comparable the measures of economic costs and benefits.

The models usually used to measure the contribution of higher education to economic productivity are imperfect; serious conceptual and data questions arise. Do wage and earnings differentials accurately portray the economic contribution of higher education? Does the entrance screening process of the

higher education system serve to select individuals of exemplary ability? If so, then some component of the apparent earnings reward for higher education is actually due to differences in ability and the return to higher education is overstated. It is difficult to test empirically for the effect of ability on wage differentials. However, as an intermediary step, the benefit model used in this study was designed to selectively deduct a proportion of the earnings differential in order to test the degree of sensitivity of results to this factor and make some inferences on its possible impact on the benefit-cost ratio.

The benefit model used here was also adjusted for labour force participation, economic growth and taxation. Unemployment and economic growth may serve to distort the meaning of earnings differentials with respect to the real social value of post-secondary education. Earnings differentials should be adjusted to take into account the effect of progressive taxation on these returns.

Public investment in higher education may affect income distribution. Money derived from a particular tax structure which inflicts a given distribution of burdens upon the various income classes of a society supports part of post-secondary education, which in turn gives certain individuals enhanced earning power.

A model designed to analyse the income redistributive effect of investment in higher education must break down the contribution of the various income classes to the public fund which supports higher education in Ontario. It must show the distribution of members of these classes into sub-sectors of the higher education system, develop weighted indices of the income class-specific benefits of higher education, and compare the income class-specific cost and benefits of higher education.

The final step, in which income class-specific costs and benefits of higher education are compared, should reveal whether investment in higher education is regressive, progressive or neutral. The model used in this study does these things.

### 3. THE ANALYTIC MODELS USED IN THIS STUDY

This analysis of the costs and benefits of post-secondary education in Ontario uses three analytic models. Although the models have been constructed separately (each is founded on a separate set of theoretical principles), they must be used inter dependently. The cost model generates various statistics on the costs of post-secondary education in Ontario. Both the benefit and income-redistributive models must be used in conjunction with the cost model to generate benefit-cost and income-redistribution statistics, respectively.

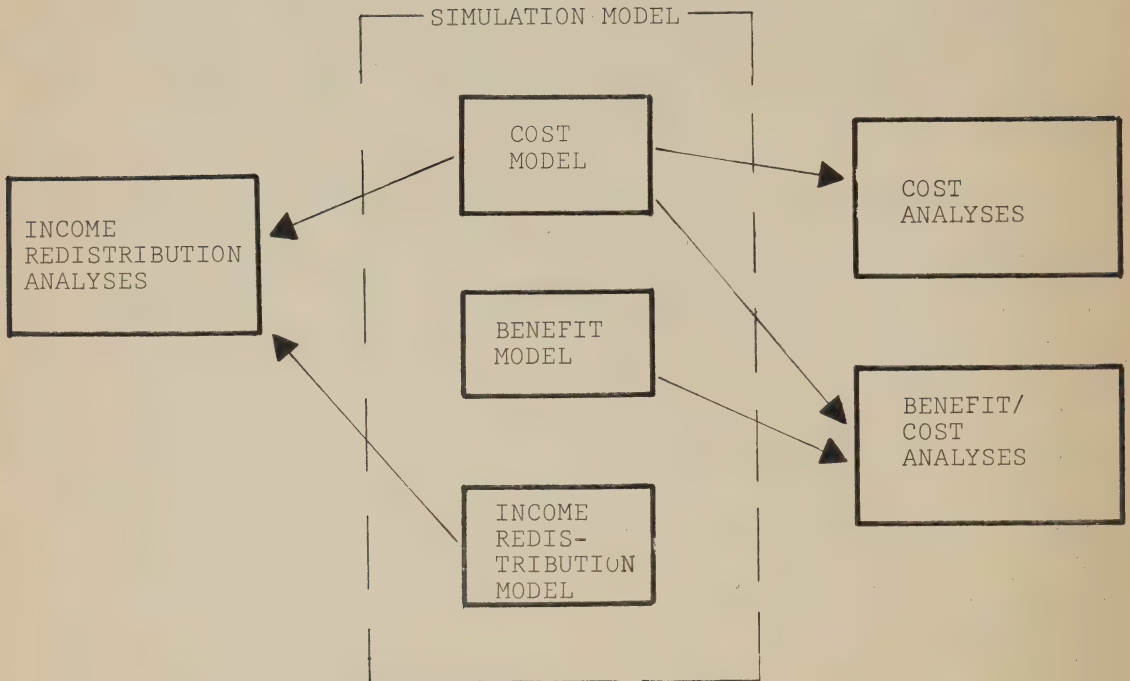
Simulation capabilities have been added to this three-model system so that it is a relatively simple task to vary parameters and perform experiments based on alternate hypotheses. Figure 2 displays the simple interrelationships among the three components of the system.

#### 3.1 Cost Analysis Model

The major objective of this model is to present comprehensive documentation on all costs, both private and social, associated with any post-secondary educational program in Ontario.

All cost data pertain to the time period 1968-69 and have been gathered from primary sources in educational institutions or the relevant government departments.

Both direct and opportunity costs are considered in this study. Direct costs represent actual expenditures which have occurred during the specified time period and reflect real financial flows. Opportunity costs are costs which do not appear in conventional accounting records and do not entail actual dollar outlays. They represent the earnings that might have been obtained if the assets

FIGURE 2COMPONENTS OF THE STUDY

currently committed to post-secondary education had been applied to some other at least as profitable use.

Individual programs have also been costed by levels (i.e. academic years) and programs or aggregates (degrees or certificates). This was done as follows:

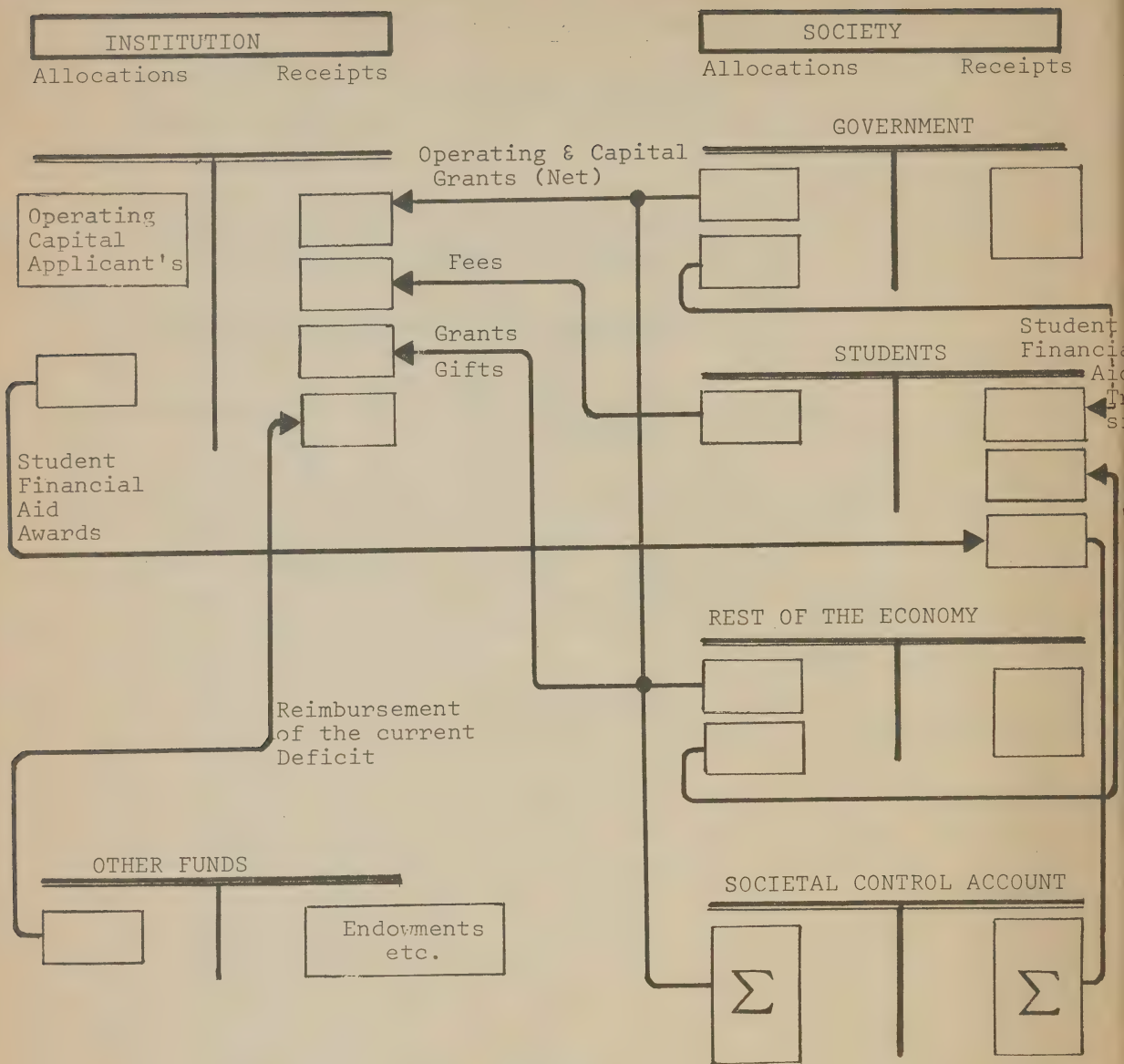
- 1 A Trial Balance of institutional and societal costs was constructed to illustrate the breakdown of financial commitments between the institution and society.
- 2 Institutional and Societal costs per student were broken down by program and by academic year.
- 3 Estimates were made of institutional degree costs by program.

The conceptual key to the cost module in this study is the Trial Balance accounting system which documents the financial transactions between the institutionalized post-secondary educational system and the rest of the social system. Thus there are two quasi-systems, INSTITUTION and SOCIETY. In addition, the SOCIETY account is broken out into three categories, in which expenditures are attributed to STUDENTS, GOVERNMENT and THE REST-OF-THE-ECONOMY.

The Trial Balance is intended to give a general picture of the existing financial interrelationships between the institution and society and its sectors, and among the sectors themselves. A double-entry bookkeeping system is applied to the treatment of these financial interrelationships.

A schematic representation of the Trial Balance is shown in figure 3. The right hand portion of the diagram represents the Society control account with its sub accounts - Government, Students and Rest-of-the-Economy.

FIGURE 3



There are two types of financial transactions depicted in this diagram - transactions between Society and the Institution (e.g. Operating and Capital Grants, Fees and Gifts) and transactions within Society depicted as financial aid received by students from Government or the Rest-of-the-Economy. On the Institution side of the diagram an Other Funds account allows for the possibility of an institution's utilizing its own funds (possibly profits derived from outside companies which it owns) to subsidise its yearly operation.

Table 1 lists the direct and opportunity cost categories used in the Trial Balance while figure 4 is an example of the actual Trial Balance.

Consequently, post-secondary education (or any of its components) is viewed as an integrated income-expenditure account. Each institution utilizes income from Government, Students and the Rest-of-the-Economy together with its own funds as a source for financing of all operations and capital projects. Financial flows from Government to a particular Institution are recorded as allocations from government expenditures and receipts to the particular institution. Thus the Trial Balance accounts provide a comprehensive picture of all direct (monetary) and opportunity costs associated with post-secondary education in Ontario.

Basically, there are three underlying assumptions in the concept of the Trial Balance:

1. Each educational institution is operated on a breakeven or non-profit basis with respect to the expenditures considered.
2. Monetary transfers within the GOVERNMENT, STUDENT, and REST-OF-THE-ECONOMY sectors are made at zero costs to society (although there may be redistributive effects among the various socio-economic strata).

## EXPENDITURE CATEGORIES

TABLE 1

1	Government Operating Grants
2	Gifts for Operating Purposes
3	Student Fees
4	Student Academic Equipment
5	Ontario Student Aid Program Grants
6	Ontario Student Aid Program Loans Expenditures
7	Ontario Graduate Fellowships
8	Gifts for Student Financial Aid
9	Institutional Student Awards
10	Direct Student Awards
11	Institutional Net Expenditures
12	Government Capital Grants
13	O.U.C.A.C. Financing
14	Mortgage Financing
15	Other Financing
16	Campaign and Capital Gifts
17	Depreciation
18	Repayments to O.U.C.A.C.
19	Other Repayments
20	N/A
21	Government Refund of Sales Tax
22	Government Operating Grants
23	Government Capital Grants
24	Gifts
25	Loss of Tax from Gifts
26	Ontario Student Aid Program Grants & Fellowships
27	Ontario Student Aid Program Loans Expenditures
28	Direct Student Awards
29	Loss of Tax from Direct Awards
30	Student Fees
31	Student Academic Equipment
32	Loss of Tax on Student Expenditures
33	Foregone Student Annual Earnings
34	Loss of Tax on Student Foregone Earnings
35	Institutional Employed Capital
36	Loss of Corporation Tax
37	Loss of Property Tax

## TRIAL BALANCE ACCOUNTS SIDES

1	Allocation of Resources	-	Debit Side
2	Receipts of Resources	-	Credit Side

UNIVERSITIES	AGGREGATE		T R I A L    B A L A N C E				REST OF THE ECONOMY ALLOCA T S RECEIPTS	SOCIETY ALLOCA T S RECEIPTS
	INITIAL AMOUNT	RATE PCT.	INSTITUTION ALLOCA T S RECEIPTS	STUDENT ALLOCA T S RECEIPTS	GOVERNMENT ALLOCA T S RECEIPTS			
1	229102464	1.000	229102464		229102464	1514008	229102464	
2	1514008	1.000	55454216				1514008	
3	55454216	1.000	22374682				55454216	
4	22374682	1.000		16761546	16761546		22374682	
5	16761546	0.057		1053598	1053598			
6	1053598	1.000		4415539	4415539			
7	4415539	1.000				199488		
8	199488	1.000	2067326		2067326		199488	
9	2067326	1.000					2067326	
10	310416466	1.000	310416466					
11	47668000	1.000	47668000		47668000		47668000	
12	120850000	1.000	120850000		120850000		120850000	
13	10264000	1.000	10264000			10264000		
14	10264000	1.000	3812000			3812000		
15	3812000	1.000	7268000			7268000		
16	7268000	1.000					7268000	
17	1047455356	0.057	59704955					
18	17084000	1.000	17084000		17084000		17084000	
19	7451000	1.000	7451000			7451000	7451000	
20	7451000	1.000					7451000	
21	59704955	0.040						
22	396723747		2388198		2388198		2388198	
23	81796627		77828898		24298009	23057496	500895056	
24					405155345		474292730	
25								
26								
27								
28								
29								
30	55454216	0.070	3881795			628705	16037172	
31	22374682	0.070	1566228				10600380	
32	5448023	0.100		544802	544802		628705	
33	232044170	1.000	232044170		23204417		1482396	
34	232044170	0.100					73752	
35	1348122296	0.090						
36	819489148	0.020						
37								
	SUBTOTALS		94414061	237492193	115602602	628705	329911411	
	SURPLUS		30817248					
	BALANCE							
	TOTALS		572934432	315321091	537841947	565835	830806467	
	BALANCE			267273863	520757947	16172331	804204141	

- 2
3. Social expenditures and receipts are the algebraic sum of the GOVERNMENT, STUDENT and REST-OF-THE-ECONOMY expenditures.

Four types of cost analyses are generated from the Trial Balance:

1. The private costs of a particular educational program. This includes all direct and opportunity costs incurred by students (or their families) who attend post-secondary educational programs.
2. Institutional cost per student per year, by program. These include all of the costs which are associated with various grade levels of the post-secondary programs in Ontario.
3. Social cost per student per year. These are the combined social and private costs (direct and opportunity costs) associated with each program.
4. Institutional expected degree cost for Undergraduate, Master's, and Doctoral degrees in all programs. These consist of the institutional cost per year modified by the conditional probabilities of passing each year of a program successfully, until graduation.

The four cost estimates generated by the Trial Balance accounts provide basic data for the cost-benefit and the income-redistribution models. In addition, the costs are compared to illustrate the relative burdens of expenditure on post-secondary education in Ontario between the private and social sectors, as well as to illustrate the implicit loss to the system from student dropouts.

### 3.2 Income Redistribution Effects Model

Investment in post-secondary education may cause income redistribution. This occurs as a result of a divergence between the demand for various types of higher education by different income groups and their relative contributions to the tax support of post-secondary education.

The income redistribution model uses data from the Trial Balance generated in the cost model. The major task is to apportion costs among the income classes and the model develops a scheme which traces the distribution of costs and benefits among the income groups of society.

This model represents a continuation of the work previously published by R.W. Judy<sup>E-37</sup> but utilizes a more extensive data base than was available to Judy at the time of his study.

The objectives of the income-redistribution model are as follows:

1. To define income groups as the basic units of the analysis.
2. To distribute the gross Student, Government, and the Rest-of-The-Economy costs among the income groups.
3. To define the student benefits.
4. To distribute these benefits among the income groups in order to indicate the redistributive aspects of investments in post-secondary education.

Before discussing the approach used in this study in more detail, it should be emphasized that the concept of income-

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E-37 Judy, R.W. "The Income Redistributive Effects of Public Financial Assistance of Higher Education in Canada", Canadian Economic Problems and Policies, McGraw Hill, March, 1970.

redistribution may be defined in a number of ways - for example:

i. Regional income-redistribution

Income groups are defined by region, and the redistribution occurs from groups in one region to those in another. To estimate such effects, it would be necessary to identify regions in Ontario with different income bases and different levels and structures of expenditures on post-secondary education. The migration into and out of such regions by educated manpower would result in regional income redistribution if the outflow of graduates did not coincide with the inflow.

ii. Inter-generational income-redistribution

Income groups are characterized by temporal attributes and income redistribution would occur among age groups. The public support of post-secondary education rests on a tax base supported mainly by the older working population yet most of the demand for such services comes from younger individuals. This form of public investment can be thought of either as a subsidization of the younger generation by an older generation or as inter-generational redistribution of income.

Although the concepts of regional and inter-generational income redistribution in post-secondary education are interesting, it is difficult to formulate them into an operational model.

To conceptualize models for regional and inter-generational income redistribution requires definition of the direct inter-regional financial flows supporting post-secondary education and an exhaustive list of such inter-regional costs and benefits. It may be possible to show that any region which has a net deficit in its investment "account" for post-secondary education receives many intangible returns from other regions in the economy. Examples of such intangible returns, which cannot be empirically defined in any model, include the differential impact of economic growth on the regions of an economy; the effect on consumer demand for consumption or service commodities which are only produced in certain regions of the economy and post-secondary education's contribution to a "public frame of mind" which supports fiscal and taxation policies for inter-regional equalization.

Similarly, the concept of inter-generational income redistribution of public investment of post-secondary education may lack meaning, although any investment in education may be represented as a subsidization of the younger generation by an older generation which does not partake of the direct benefits.

Further, it is exceedingly difficult to find data which describe even the direct regional and inter-generational income redistributive effects of investment in post-secondary education. Such models require data which would describe the components of the costs of education by two attributes, income class and either regional or inter-generational characteristics. Such data are not readily available.

### iii. Intra-generational income redistribution

The model simply describes income redistribution among income groups of a particular generation. Both conceptual and empirical difficulties restrict this study to an analysis of the intra-generational income redistribution aspects of investment in higher education. However, even this limited study must overcome real conceptual and methodological restrictions. The scope of the limitations is evident in the assumptions which were of necessity built into the model.

#### 3.2.1 Assumptions and Limitations

1) Costs and benefits are attributed to five income classes, defined on the basis of 1961 census data and assuming that the family unit appropriates both costs incurred and benefits received. By organizing the model around the family unit, we neutralize the consideration of inter-generational readjustments.

2) Costs and benefits in the income redistribution model are defined in a unique manner. Costs are defined as the total direct and opportunity costs, for each post-secondary educational program, attributable to the families of the five selected income groups. Thus, total program costs, regardless of their immediate origin (e.g. a government fund), are attributed to their base origin in one of the five income groups meeting the costs. Benefits, on the other hand, are defined as public subsidies of the higher education programs apportioned according to their income class-specific end-use by individuals engaged in higher education programs.

Thus, the income redistribution model compares income class-specific private costs of the various educational programs and public contributions to these programs made on behalf of the five income classes, defined by the income class-specific distribution of students in the educational programs.

The steps involved in the income redistribution model are listed here.

- 1) The total societal cost of each educational program in Ontario is broken down by Trial Balance cost category.
- 2) Each cost category is identified according to component(s) of the SOCIETY account which are responsible for funding.
- 3) Each of the components of the society account is further disaggregated to show the total contributions of five income classes (under \$3,000, \$3-4,999, \$5-6,999, \$7-9,999 and \$10,000 and over) by program.
- 4) The results of these three steps are combined to compute the total contributions of the five income classes to the costs of each higher education program. These computations, expressed as proportions, show the contributions of the five income groups to the support of the program.
- 5) Student benefits have been defined as "public subsidies". In order to compute student benefits, the Government and Rest-of-the-Economy program costs are apportioned on the basis of each income group's representation within each program.

The following explicit assumptions were made in the model:

- 1) Student Cost - All student costs are considered from the point of view of the student's family.
- 2) Parents and Students - No distinction is made between those parents whose children attend a post-secondary institution and those without children or whose children do not attend a post-secondary institution.

- 3) Full versus Subsidized Cost - In the absence of government (operating and/or capital) grants or other gifts and contributions, the students would be forced to pay all costs which they incur or create by attending post-secondary institutions. Therefore, these grants and contributions are attributed in the model as indirect benefits to the student.
- 4) Source of Government Grants - Government grants and subsidies are taken from the general revenue fund of both the provincial and federal governments, and these consist of all tax revenues which are not collected for specific allocations (i.e. by this definition, hospital premiums are not a part of the general revenue fund).
- 5) Share of the Tax Burden - Each income group is still paying the same relative percentage of the tax burden as they were in 1961. This is a weak but essential assumption.
- 6) Socio-economic Composition of Enrolment - The socio-economic composition of enrolment in post-secondary educational institutions were derived from two sets of data, taken in 1968-69 and in 1961. These data were rendered comparable by assuming that the relative differences between the various programs remained unchanged between 1961 and 1968.
- 7) Government Operating Grants - These grants are made by the provincial government but include a 50 per cent contribution by the federal government. The provincial government bears the remaining costs less the amount collected in tuition fees.
- 8) Gifts (Operating and Student Financial Aid), Mortgage, and Other Financing - One half of the cost of gifts is borne directly by the two highest income groups with the highest group responsible for two-thirds of this amount. The remaining 50 per cent is assumed to be spread over all other groups.
- 9) O.S.A.P. Grants - It is assumed that the average award is \$953 in all programs except law, medicine and the last year of dentistry in which the average award is estimated to be \$1,354.
- 10) Ontario Graduate Fellowships - These are only offered in certain non-professional programs and consist of \$1,500 for full-time winter students and \$750 for summer students.
- 11) Refund of Sales Tax - It is assumed that approximately two-thirds of the amount refunded is a federal government subsidy.

The income redistribution analysis in this study provides some insight into the distribution of the costs and benefits of post-secondary education in Ontario. By comparing the costs and benefits for each of the five income classes, the degree of regressivity or progressivity or the degree to which one income class is subsidized by another by virtue of public investment in post-secondary education, can be described.

One must be careful, however, not to misinterpret the results of such an analysis. There are essentially no social, political or economic connections between the income class-specific measures of societal costs and student benefits. The former is defined in the complicated political procedure which establishes the public taxation base. Public decision-making on this matter responds to a need for equity and efficiency. The latter is defined by the income class demand for post-secondary education and this, in turn, is determined by a large set of individual investment and consumption decisions.

This caveat begs the question: what does the notion of regressivity mean when applied to expenditures on one public investment program? Perhaps it can be shown that some public investment projects in human capital formation (say, public health investment) are progressive while others (say, some higher education programs) are regressive. Is one more equitable than the other? As long as freedom of choice is preserved, and there are no barriers to entry, the notion of equity has little meaning.

These comments are intended to reduce misinterpretation of the results of the income redistribution model. The model retains its validity solely as a device to provide structured information about selected implications of public investment in post-secondary education.

### 3.3 Benefit Analysis Model

The post-secondary education system has many effects on a country's economic, social and political condition. All of these effects are important but the model is unfortunately restricted to the consideration of effects which can be measured and documented. Consequently, although there may be general agreement that post-secondary education provides society with aesthetic benefits and individuals with psychic and prestige benefits, these are not explicitly accounted for in the model.

The benefit model used in this study includes only direct economic benefits. In other words, both social and private benefits are expressed as the expected increase in lifetime earnings associated with a particular type and level of post-secondary education. It is assumed that the increase in lifetime earnings reflects the gains in economic productivity associated with investment in post-secondary education and human capital formation. This direct measure of economic benefits, however, excludes any measure of post-secondary education's indirect contribution to economic wealth through external economies, which cannot easily be measured.

Although benefits are defined in the model as the economic returns attributable to post-secondary educational programs, no data exist on the specific earnings of graduates of the various programs. Occupational data are used instead and are transformed to program-specific earnings schedules.

The earnings data were obtained from the 1961 census and also from more recent government surveys and were updated to a common base year (1968). In order to reflect the future expected gain in lifetime earnings for current post-secondary students and graduates, certain modifications were made to the data.

### 3.3.1 Private Returns to Post-Secondary Education

Although the model has been formulated to estimate the returns to all levels of post-secondary education (i.e. successful or unsuccessful degree/diploma candidates at all levels through to the Ph.D) limitations in data and time have restricted this study to estimation of returns to successful first degree/diploma candidates as compared to a successful high school graduate who did not continue schooling.

The simplest measure of increased earnings would be a year by year comparison of earnings over the working lifetime of an individual. However, in such a computation, adjustments must be made for the effects of taxation, labour force participation, real growth in per capita income, mortality, ability of the student, non-pecuniary benefits, and net migration. Each of these items has the effect of modifying the earnings data so that they more accurately reflect the real social returns attributable to post-secondary education.

#### i) Taxation Period

Some of the increased earnings associated with post-secondary educational attainment revert to society through progressive taxes. When calculating private returns to education only net income is considered but in calculating social returns gross income is included as taxes revert to the public sector.

#### ii) Labour Force Participation

Unemployed workers do not contribute to economic production. As the earnings data in this model represent earnings of fully employed workers, these data must be adjusted to account for expected unemployment. As unemployment varies with each occupation, this adjustment should be occupation-specific.

iii) Real Growth in Per Capita Income

As this study uses cross-sectional data on earnings (i.e. data from many different age groups) the measurement of expected gain in lifetime earnings must be adjusted for expected real growth in per capita income.

iv) Mortality

Social costs have been specified as the costs to society of producing graduates from the various post-secondary education programs. Pre-retirement mortality is considered a deadweight social loss of investment in human capital. Hence the calculation of future expected gain in life-time earnings must be adjusted for mortality.

v) Ability of the Student

The earnings data should be adjusted to reflect the fact that only individuals of higher academic ability are normally channeled into the post-secondary education system. If an adjustment is not made, then the earnings differentials may overstate the returns to post-secondary education. However, since no empirical measures of the relative effects of ability on earnings differentials exist, the model is designed to accept assumptions (in the form of coefficients) about the proportion of earnings differentials actually attributable to post-secondary education and ability.

vi) Non-Pecuniary Benefits

As post-secondary education produces benefits which are not reflected in income differentials, the model contains a variable which allows experimentation to test the effect of various

3

assumptions regarding non-pecuniary benefits of higher education.

vii) Net Migration

Graduates of Ontario post-secondary institutions who migrate to other jurisdictions represent a net transfer of human capital and a net loss of the returns from social investment. The model contains a component which allows experimental variation according to assumptions about this variable.

The difference in earnings streams, modified by all of the above factors, still presupposes that the student has already graduated. To reflect the uncertainty or risk associated with entrance into a given post-secondary educational program and successful completion, a probabilistic estimate of success in a given program is computed from available enrolment data.

The individual who has successfully completed a program of study may choose several occupational careers. The choice of a particular occupation determines future earnings, so a probabilistic estimate is made of entrance into the various career possibilities.

The application of these probabilistic factors on the modified earnings streams yields an estimate of the expected increase (or decrease) in lifetime earnings.

In summary, the computational procedures used in the benefit model are:

- 1) Raw DBS data on lifetimes earnings for all categories of occupations are compiled.
- 2) Each of the earnings schedules are adjusted for the effect of taxation, labour force

participation, real growth in per capita income, mortality, ability, non-pecuniary benefits and net migration.

- 3) Similar adjustment factors are applied to the earnings of high school graduates which are then subtracted from the adjusted occupation specific earnings.
- 4) The probability that students will successfully pass through a given program without dropping-out is applied.
- 5) The probabilities of the graduates entering into each occupational category are applied.
- 6) The adjusted occupation-specific earnings data are combined with the probabilistic estimates to produce the expected increase (or decrease) in lifetime earnings of the post-secondary graduates.

Once the expected earnings differentials are computed, three separate measures of private returns are calculated for each program as follows:

i) Net Present Value (NPV)

Basically, this statistic represents the lifetime value of post-secondary education expressed as a lump sum payment upon graduation.

Mathematically

$$NPV_k = \sum_{j=1}^M \frac{Z_{jk}}{(1+r)^{j-1}} - SC_k$$

Where  $k$  = a post-secondary program designation  
 NPV = net present value  
 SC = student costs  
 $j$  = a year variable  
 $Z_{jk}$  = expected earnings by year  $j$  given graduation from program  $k$   
 $M$  = final working year after graduation  
 $r$  = discount rate

ii) Benefit Cost Ratio (B/C)

This statistic represents the ratio between the lump sum of lifetime benefits and the lump sum of costs incurred during the educational process.

Mathematically

$$(B/C)_k = \frac{\sum_{j=1}^M Z_{jk}}{(1+r)^{j-1}} / SC_k$$

iii) Rate of Return (R/R)

Essentially, this statistic represents the equivalent interest rate returned on the lump sum of costs invested in post-secondary education.

Mathematically

$$SC_k = \frac{\sum_{j=1}^M Z_{jk}}{(1+(R/R))^{j-1}}$$

### 3.3.2 Societal Returns to Post-Secondary Education

The procedure for computing the societal returns to post-secondary education is similar to that used for the computation of student returns, except that:

- a) no tax adjustment is applied to the calculation of earnings differentials
- b) the computation of Net Present Value, Benefit/Cost ratio and Internal Rate of Returns, uses societal costs rather than student costs.

It should be noted that in computations of both the private and societal measures of educational profitability (NPV, B/C and R/R), the costs have not been discounted for time. Although this simplification reduces the computational problem, it gives each measure a small upward bias.

### 3.3.3 Detailed Description of Methodology

The foregoing descriptions of the cost, redistributive and benefit models (sections 3.1, 3.2, 3.3) have presented a broad general outline of the techniques employed without specifying all of the particular assumptions made nor all of the explicit mechanical details on the derivation of data or calculations made on or with the data. The reader who is interested in the technical aspects of this study is referred to the second volume, which goes into explicit and complete detail on all aspects of the data and the model.

#### 4. ANALYSIS OF RESULTS

This section deals with the results obtained from the cost and benefit model. The results are described in the reverse order to which they were generated, that is, the aggregate results are presented first and then decomposed into more detail.

Universities are treated with a greater amount of detail. This reflects the fact that more data are available on universities and university graduates than on the remaining post-secondary institutions. This limitation is not extremely severe, however, because universities contain the major proportion of the post-secondary student population, in spite of the fact that only 15 of the approximately 110 post-secondary institutions in Ontario are classified as universities.

The reader is reminded that the results are based on the best data available and the most reasonable and (in most cases) most conservative assumptions. The aim of this study is to present a cost, redistribution and benefit analysis for the academic year 1968-69. No attempt should be made to extrapolate these results into the future, because the nature and scope of government funding and in student opportunity costs may have changed since 1968-69.

##### 4.1 Enrolment Analysis

Enrolment statistics are the most general type of information which can be provided about the post-secondary education system. They are expressed in full-time equivalent students or as percentages of total enrolments.

From table 2 it can be seen that the full-time equivalent student enrolment in the post-secondary system is

SUMMARY OF  
1968-69 ENROLMENT STATISTICS  
BY INSTITUTION TYPE

INSTITUTION TYPE	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
UNIVERSITIES	101,427	63.6
COMMUNITY COLLEGES	37,623	23.6
TEACHERS COLLEGES	10,863	6.8
NURSING SCHOOLS	8,867	5.6
AGRICULTURAL COLLEGES	705	.4
TOTALS	159,485	100.0

159,485 students. The number of actual people affected by this system is considerably higher as part-time students are reduced to full-time equivalents (a conversion of 5 or 6 part-time students to 1 full-time student is used). It is not unlikely that as many as 200,000 individual students may actually be represented.

Although there are only 15 universities, their students represent at least 63% of the total student population while the other 100 institutions contain the remainder of the student population in the proportions shown.

Table 3, which describes the university program enrolments (where graduate and under-graduate students are combined), indicates that General Arts and Honour Arts together represent 48%, or approximately half, of the total university enrolments. When General Science and Honours General Science enrolments are added, the total accounts for 65% of all university students.

Table 4 shows the enrolments in Community Colleges and in Teachers' Colleges. It should be pointed out that the last four items listed in the Community College enrolment statistics (Business, Technical, Arts and Health) refer to programs offered by Ryerson Polytechnical Institute which is unique and, operates under its own special charter, making submissions to the Department of Education as a separate entity. The data shows that no one program dominates Community Colleges enrolments.

In the Teachers' Colleges the most popular program is the one year teacher training program from which almost all of the primary school teachers graduate. Although the Colleges of Education are affiliated with the universities,

## UNIVERSITIES

## 1968-69 ENROLMENT STATISTICS

TABLE 3

PROGRAM NAME	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
AGRICULTURE	1022	1.0
ARCHITECTURE	415	0.4
COMMERCE	4430	4.4
DENTISTRY	602	0.6
ENGINEERING	9503	9.4
FINE AND APPLIED ARTS	253	0.2
FORESTRY	239	0.2
HOUSEHOLD AND FOOD SCIENCE	877	0.9
HYGIENE - PUBLIC HEALTH	115	0.1
JOURNALISM	293	0.3
LAW	2142	2.1
LIBRARY SCIENCE	385	0.4
PREMEDICINE AND MEDICINE	2449	2.4
MUSIC	580	0.6
NURSING	1134	1.1
PHARMACY	509	0.5
PHYSICAL AND HEALTH EDUC.	2359	2.3
PHYSICAL AND OCC.THERAPY	45	< 0.1
SOCIAL WORK	535	0.5
VETERINARY MEDICINE	319	0.3
THEOLOGY	102	0.1
HON.GEN.ART 1/GEOGRAPHY	37583	37.1
HON.ART UPPER HUMANITIES	10897	10.7
HON.GEN.SCI. 1/PHYS-BIOL	11094	10.9
UPPER YRS HON SCI/MATH	6837	6.7
SECRETARIAL/CHILD STUDY	184	0.2
HOSPITAL ADMINISTRATION	55	0.1
LANDSCAPE ARC/PSYCHOLOGY	750	0.7
PUBLIC ADMINISTRATION	79	0.1
DIP.PUBLIC AD/RES. SOC.SCI.	1061	1.0
DIPLOMA GENERAL ARTS	58	0.1
DIPLOMA COMMERCE	300	0.3
DIPLOMA MUSIC	33	< 0.1
DIPLOMA NURSING	134	0.1
DIPLOMA PHYS. OCC. THERAPY	380	0.4
DIPLOMA GEN. SCIENCE	10	< 0.1
DIPLOMA NURSING TECH	114	0.1
DIPLOMA DENTAL HYGIENE	86	0.1
DIP. PUBLIC HEALTH NURSING	194	0.2
DIPLOMA TECHNOLOGY COURS	397	0.4
DIPLOMA PRELIMINARY YEAR	917	0.9
DIP.MED. INTERN-RESIDENTS	1321	1.3
OISE	635	0.6
TOTALS	101427	100

TABLE 4

COMMUNITY COLLEGES  
1968-69 ENROLMENT STATISTICS

PROGRAM NAME	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
3 YR BUSINESS	2918	7.8
2 YR BUSINESS	3683	9.8
1 YR BUSINESS	614	1.6
3 YR APPLIED ARTS	1112	3.0
2 YR APPLIED ARTS	3089	8.2
1 YR APPLIED ARTS	417	1.1
3 YR TECHNOLOGICAL	3648	9.7
2 YR TECHNOLOGICAL	3966	10.5
1 YR TECHNOLOGICAL	319	0.8
APPRENTICESHIP TRAINING	2219	5.9
OTHER	3917	10.4
MANPOWER RETRAINING	3554	9.4
BUSINESS	1999	5.3
TECHNICAL	4554	12.1
ARTS	1405	3.7
HEALTH	209	0.6
TOTAL ENROLMENT	37623	100.00

TEACHERS COLLEGES  
1968-69 ENROLMENT STATISTICS

PROGRAM NAME	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
TEACHER TRAINING 1 YR	10120	93.1
TEACHER TRAINING 2 YR	273	2.5
TEACHING U. GRADUATE	376	3.5
PRIMARY SPECIALIST	94	0.9
TOTALS	10863	100.00

they have been represented here as the 'Teacher Training University Graduate' program.

Table 5 shows enrolments for Nursing Schools and Agricultural Colleges. From these enrolment statistics it is evident that the most popular program is not the shortest "Nursing 2 Year" but rather the longer "Nursing 2 + 1" program. The latter program contains an additional year of practical training in a hospital, during which students are paid a monthly stipend of \$375. The attractiveness of this program is probably due to the relatively higher pass-rates of its candidates on the College of Nurses licensing examination.

In the Agricultural Colleges, predictably, the most popular program is Agriculture attracting 61% of all the students. The Agricultural Colleges probably attract a fairly large female contingent as 23% of total enrolment is in the Home Economics program which is presumably oriented towards females.

In summary, the 1968 secondary school graduate, when faced with the decision to continue his education, was most likely to opt for University or Community College 87% of the time. The remainder chose Teachers Colleges. In fact, female students who were not going on to University, were about as likely to choose Nursing - as Teaching. Further, since the training time in Nursing (3 years) is much longer than in Teaching (1 year) one could make the assumption that the relatively more affluent students would be more likely to go into Nursing, particularly since nurses earn approximately the same as teachers.

TABLE 5

NURSING SCHOOLS  
1968-69 ENROLMENT STATISTICS

PROGRAM NAME	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
NURSING 2 YR	1009	11.4
NURSING 2 + 1	6744	76.1
NURSING 3 YR	1114	12.6
TOTALS	8867	100.00

AGRICULTURAL COLLEGES  
1968-69 ENROLMENT STATISTICS

PROGRAM NAME	ENROLMENT IN F.T.E.	PERCENTAGE OF TOTAL
AGRICULTURE	433	61.4
HOME ECONOMICS	167	23.7
ANIMAL HEALTH	87	12.3
DAIRY SHORT COURSE 3 MTHS	18	2.6
TOTALS	705	100.00

## 4.2 Cost Analysis

In allocating resources among alternative uses, the two most important decision-criteria are their costs and benefits. In the education domain, costs are often more concrete and explicit than benefits. Although the student may view the benefits of post-secondary education as increased lifetime earnings, the taxpayer who himself did not attend, or whose children do not attend post-secondary education, may have an entirely different perspective. For this taxpayer, benefits are difficult to define but costs remain eminently real in the form of taxes.

It is important to realize not only the relative proportion of allocations among various programs, but also their magnitudes and expected returns. This section provides a detailed analysis of all cost data, first from an aggregate viewpoint and then at given levels of disaggregation.

The Trial Balance generated in the cost model (see section 3.1) may be aggregated to produce a table which is easier to read but lacks the detailed mapping of each financial transaction with respect to the type of transaction (e.g. operating grants, capital grants, student fees) and the sectors involved (Student, Government or Rest-of-the-Economy).

In order to facilitate reading Trial Balance Aggregates, two definitions are required.

### 4.2.1 Direct Costs

These are the costs which represent actual expenditures which have occurred and been paid in

the time period under consideration (1968-69)

a) Institution

The institutional direct costs consist of expenditures on

- i) student awards
- ii) expenditures on salaries and operating expenses
- iii) expenditures due to depreciation such as replacement of assets
- iv) repayments of current debts and related interest payments.

b) Students

Student expenditures consist of

- i) tuition costs
- ii) equipment expenditures

c) Government

Government expenditures consist of

- i) operating grants
- ii) student aid program covering grants loans and fellowships
- iii) capital grants and capital financing
- iv) rebates of sales taxes

d) Rest-of-the-Economy

Private Business expenditures consist mainly of gifts to the institution, either through large private donations or through alumni funds. This holds true only for universities as no gifts were indicated for the other institutions.

#### 4.2.2 Opportunity Costs

These are costs which do not appear in conventional accounting records and do not entail actual

dollar outlays. They represent the earnings that might have been realized if the assets currently used in post-secondary education had been applied to some other (presumably more profitable) alternate use.

a) Institution

The institution opportunity costs are associated with the possible returns from the Institutional Employed capital (Land, Buildings, Funds).

b) Student

Student opportunity costs consist of foregone interest on tuition and equipment expenses as well as foregone earnings.

c) Government

Government opportunity costs consist of foregone interest on all of its direct costs as well as foregone taxes on the opportunity costs of the other sectors of society and the institution.

d) Rest-of-the-Economy

The opportunity costs in this sector consist of foregone interest on gifts made.

#### 4.2.3 Discussion of Results

The results of any study are strongly influenced by the assumptions.

1) All costs used in the Trial Balance are as taken from the primary sources and exclude (insofar as was possible) the costs of sponsored research.

TABLE 6

## ALL INSTITUTIONS

1968-69 TRIAL BALANCE AGGREGATE

## (A)

EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	511.82	69.87	509.16	15.58	594.61
Opportunity Costs	34.66	293.78	139.83	0.57	434.18
Total Costs	546.48	363.65	648.99	16.15	1028.79

## (B)

PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	93.7	19.2	78.5	96.5	57.8
Opportunity Costs	6.3	80.8	21.5	3.5	42.2
Total Costs	100	100	100	100	100

## (C)

PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	11.8	85.6	2.6	100
Opportunity Costs	-	67.7	32.3	0.1	100
Total Costs	-	35.3	63.1	1.6	100

- 2) The cost of maintaining the student aid loan program was taken as  $6\frac{1}{2}$  percent of total loans.
- 3) The overall depreciation rate on buildings and equipment was taken as 5.7 percent (representing the average of a 40 year lifespan for buildings and 5 years on equipment).
- 4) The new construction is to the extent of depreciation with a 4 percent rebate of sales tax.
- 5) The opportunity rate on all costs was 7 per cent.
- 6) The tax rate on foregone student earnings was 10 percent.
- 7) The tax rate on foregone earnings from institutional employed capital was 50 per cent.
- 8) The foregone municipal taxes were 2 per cent of land buildings and equipment.

Table 6 represents the Trial Balance Aggregate for all institutions in Ontario. Part A of this table indicates that 511.8 millions of dollars in direct costs were expended by the Institutions and 594.6 by Society. This discrepancy is contrary to the assumption that institutions operate on a break-even basis. Some of the possible reasons for this discrepancy are as follows:

- 1) Fiscal and academic years overlap and are not co-incident.
- 2) Variations in the way institutions acknowledge depreciation and capital spending.

3) Institutions can "spend" some of their capital assets (e.g. sell land buildings or other holdings which would be significant in cases where institutional expenditures exceed those of society.

The opportunity costs of institutions totalled only 34.7 millions of dollars while those of society were 434.2. These figures reflect the fact that society bears large costs in terms of foregone student earnings.

Part B shows total costs, broken out by direct and opportunity costs. Institution direct costs represent 93.7 percent and the opportunity costs represent the remaining 6.3 percent. This latter figure can be considered the "shadow rent", paid by the institution.

A large proportion of total student costs, 80.8 percent, are due to foregone earnings. Since these are hidden costs, it may account for the general belief that students pay only a small proportion of the cost of their education.

Part C shows that, although students pay only 11.8 percent of the total societal direct costs, they bear 67.7 percent of the opportunity costs and 35.3 percent of the combined direct and opportunity costs.

At best, these data provide a very conservative estimate of the costs borne by the student, as "intangible" aesthetic and psychic costs are not evaluated.

The remaining 5 tables (7 through 11) depict the aggregate statistics for each type of institution.

## UNIVERSITIES

1968-69 TRIAL BALANCE AGGREGATE

## (A)

EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	396.72	53.53	405.16	15.60	474.29
Opportunity Costs	30.82	213.74	115.60	.57	329.91
Total Costs	427.54	267.27	520.76	16.17	804.20

## (B)

PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	92.8	20.0	77.8	96.5	59.0
Opportunity Costs	7.2	80.0	22.2	3.5	41.0
Total Costs	100	100	100	100	100

## (C)

PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	11.3	85.4	3.3	100
Opportunity Costs	-	64.8	35.0	0.2	100
Total Costs	-	33.2	64.8	2.0	100

COMMUNITY COLLEGES  
1968-69 TRIAL BALANCE AGGREGATE

(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	71.35	11.26	57.13	- 0.02	68.38
Opportunity Costs	3.26	52.23	16.67	0	68.90
Total Costs	74.61	63.49	73.80	- 0.02	137.28

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	95.6	17.7	77.4	100.0	49.8
Opportunity Costs	4.4	82.3	22.6	0	50.2
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	16.5	83.5	< 0.0	100
Opportunity Costs	-	75.8	24.2	0	100
Total Costs	-	46.2	53.8	< 0.0	100

NURSING SCHOOLS  
1968-69 TRIAL BALANCE AGGREGATE

(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	19.78	3.09	24.44	0	27.53
Opportunity Costs	.58	13.32	4.39	0	17.71
Total Costs	20.36	16.41	28.83	0	45.24

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	97.2	18.8	84.8	0	60.9
Opportunity Costs	2.8	71.2	15.2	0	39.1
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	11.2	88.8	0	100
Opportunity Costs	-	75.2	24.8	0	100
Total Costs	-	36.3	63.7	0	100

TABLE 10

AGRICULTURAL COLLEGES  
1968-69 TRIAL BALANCE AGGREGATE

(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	2.95	.16	2.78	0	2.94
Opportunity Costs	0	.97	.30	0	1.27
Total Costs	2.95	1.13	3.08	0	4.21

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	100	14.2	90.3	0	71.4
Opportunity Costs	0	85.8	9.7	0	28.6
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	5.4	94.6	0	100
Opportunity Costs	-	76.4	23.6	0	100
Total Costs	-	26.8	73.2	0	100

TEACHERS COLLEGES  
1968-69 TRIAL BALANCE AGGREGATE

(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	21.02	1.83	19.65	0	21.48
Opportunity Costs	0	13.52	2.87	0	16.39
Total Costs	21.02	15.35	22.52	0	37.87

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	100.00	11.9	87.3	0	56.7
Opportunity Costs	0	88.1	12.7	0	43.3
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	8.5	91.5	0	100
Opportunity Costs	-	82.5	17.5	0	100
Total Costs	-	50.5	49.5	0	100

Table 12 presents comparative cost statistics from the preceding tables. Section A shows that universities receive over 78 percent of all expenditures on post-secondary education, but contain only 63 percent of the student population. Only universities receive such a heavy resource allotment, probably because costs of teachers and equipment are higher, and universities produce a joint product in the form of graduates and academic research.

The special status afforded University and Agriculture students is reflected in the section B of this table. While the other post-secondary students pay between 36 and 50 per cent of all societal costs, the university and agriculture student pay 33 and 26 per cent respectively.

COST SUMMARY

(A)

INSTITUTION	INSTITUTIONAL EXPENDITURE	%	SOCIETAL EXPENDITURE
University	427.54	78.3	804.20
Community College	74.61	13.7	137.90
Teachers' College	21.02	3.8	37.87
Nursing	20.36	3.7	45.24
Agriculture	2.95	.5	4.21
TOTALS	546.48	100.00	1029.42

(B)

INSTITUTION	STUDENT	GOVERNMENT	REST
University	33.2	64.8	2.0
Community College	46.2	53.8	0
Teachers' College	50.5	49.5	0
Nursing	36.3	63.7	0
Agriculture	26.8	73.2	0
AVERAGE	35.3	63.1	1.6

#### 4.3 Annual Costs per Student

##### 4.3.1 Universities and Other Institutions

The results of the Trial Balance are disaggregated for much finer detail on University Costs in Tables 13, 14, 15 and 16.

Table 13 shows the institutional cost per year per undergraduate student by program, i.e. the average cost of maintaining a student in each of the years of the various programs.

The uniform nature of the costs in any of the years in most programs reflects the fact that, in constructing the Trial Balance, the formula weighting system was used to distribute most of the costs into the various programs except for some that were distributed according to fees or program enrolments.

Table 14 is similar to Table 13 except that it covers Societal costs. These are not standard as they reflect the additional foregone earnings in long programs such as Medicine and Law.

In both Table 13 and 14 the following assumptions have been made about the costs of professional programs which require preliminary study before admission.

- a) Dentistry - one year of General Science
- b) Library Science - three years General Arts
- c) Physical and Occupational Therapy - one year General Science (the enrolment statistics showed no enrolment in the first year)

UNIVERSITIES  
 INSTITUTIONAL COST PER YEAR PER STUDENT  
 BY PROGRAM (UNDERGRADUATE)

TABLE 13

PROGRAM NAME	1 ST YEAR	2 ND YEAR	3 RD YEAR	4 TH YEAR	5 TH YEAR	6 TH YEAR
AGRICULTURE	5064	5064	5064	5064	-	-
ARCHITECTURE	5064	5064	5064	5064	5064	-
COMMERCE	3803	3803	3803	3803	-	-
DENTISTRY	2542	7586	7586	7586	7586	-
ENGINEERING	5064	5064	5064	5064	-	-
FINE AND APPLIED ARTS	3803	3803	3803	3803	-	-
FORESTRY	5064	5064	5064	5064	-	-
HOUSEHOLD AND FOOD SCI.	5064	5064	5064	5064	-	-
HYGIENE - PUBLIC HEALTH	0	0	0	0	-	-
JOURNALISM	2542	2542	2542	2542	-	-
LAW	3803	3803	3803	3803	3803	-
LIBRARY SCIENCE	2542	2542	2542	3803	-	-
PREMEDICINE & MEDICINE	2542	2542	7586	7586	7586	7586
MUSIC	5064	5064	5064	5064	-	-
NURSING	5064	5064	5064	5064	-	-
PHARMACY	5064	5064	5064	5064	-	-
PHYSICAL & HEALTH EDUC.	3803	3803	3803	3803	-	-
PHYSICAL & OCC.THERAPY	2542	3803	3803	0	-	-
SOCIAL WORK	2542	2542	2542	0	-	-
VETERINARY MEDICINE	7586	7586	7586	7586	-	-
THEOLOGY	2542	2542	2542	0	-	-
HON.GEN.ART 1/GEOGRAPHY	2542	2542	2542	0	-	-
HON.ART UPPER/HUMANITIES	2542	3803	3803	3803	-	-
HON.GEN.SCI 1/PHYS-BIOL	2542	2542	2542	0	-	-
UPPER YRS.HON.SCI/MATH	2542	5064	5064	5064	-	-
SECRETARIAL/CHILD STUDY	2542	2542	2542	0	-	-
HOSPITAL ADMIN.	0	0	0	0	-	-
LANDSCAPE ARC/PSYCH.	5064	5064	5064	5064	-	-
PUBLIC ADMIN.	0	-	-	-	-	-
DIP.PUBLIC AD/RES.	2542	-	-	-	-	-
SOCIAL SCIENCE	2542	-	-	-	-	-
DIP. GENERAL ARTS	2542	-	-	-	-	-
DIPLOMA COMMERCE	2542	-	-	-	-	-
DIPLOMA MUSIC	5064	-	-	-	-	-
DIPLOMA NURSING	2542	-	-	-	-	-
DIP.PHYS.OCC.THERAPY	3803	-	-	-	-	-
DIP.GEN.SCIENCE	2542	-	-	-	-	-
DIP.NURSING TECH.	2542	-	-	-	-	-
DIPLOMA DENTAL HYG.	5064	-	-	-	-	-
DIP.PUBLIC HLTH.NURSING	5064	-	-	-	-	-
DIP.TECH. COURS.	2542	-	-	-	-	-
DIP. PRELIM. YEAR	1786	-	-	-	-	-
DIP.MED. INTERN-RESID.	3803	-	-	-	-	-
OISE	0	-	-	-	-	-

UNIVERSITIES  
SOCIETAL COST PER YEAR PER STUDENT  
BY PROGRAM (UNDERGRADUATE)

TABLE 14

PROGRAM NAME	1 ST YEAR	2 ND YEAR	3 RD YEAR	4 TH YEAR	5 TH YEAR	6 TH YEAR
AGRICULTURE	8020	8358	8696	8745	-	-
ARCHITECTURE	8286	8624	8961	9011	9636	-
COMMERCE	6571	6908	7246	7296	-	-
DENTISTRY	5131	11592	11930	11980	12605	-
ENGINEERING	8109	8447	8785	8824	-	-
FINE AND APPLIED ARTS	6574	6912	7249	7299	-	-
FORESTRY	8057	8394	8732	8782	-	-
HOUSEHOLD AND FOOD SCI.	8017	8355	8793	8742	-	-
HYGIENE-PUBLIC HEALTH	0	0	0	0	-	-
JOURNALISM	5128	5465	5803	5852	-	-
LAW	6571	6908	7259	7309	7934	-
LIBRARY SCIENCE	5123	5461	5798	7273	-	-
PREMEDICINE & MEDICINE	5176	5514	11887	11937	12562	12901
MUSIC	8034	8371	8709	8759	-	-
NURSING	8134	8471	8809	8858	-	-
PHARMACY	8034	8371	8066	8759	-	-
PHYSICAL & HEALTH EDUC.	6587	6925	7262	7312	-	-
PHYSICAL & OCC.THERAPY	5131	6925	7262	0	-	-
SOCIAL WORK	5124	5462	5799	0	-	-
VETERINARY MEDICINE	10943	11280	11618	11668	-	-
THEOLOGY	5016	5353	5691	0	-	-
HON.GEN.ART 1/GEOGRAPHY	5123	5461	5798	0	-	-
HON.ART UPPER/HUMANITIES	5123	6911	7248	7298	-	-
HON.GEN.SCI 1/PHYS-BIOL	5131	5468	5806	0	-	-
UPPER YRS.HON.SCI/MATH	5131	8368	8706	8755	-	-
SECRETARIAL CHILD STUDY	5137	5475	5813	0	-	-
HOSPITAL ADMIN.	0	0	0	0	-	-
LANDSCAPE ARC/PSYCH.	8286	8625	8961	9011	-	-
PUBLIC ADMIN.	-	-	-	-	-	-
DIP.PUBLIC AD/RES.	5019	-	-	-	-	-
SOCIAL SCIENCE	5123	-	-	-	-	-
DIP.GENERAL ARTS	5121	-	-	-	-	-
DIPLOMA COMMERCE	8034	-	-	-	-	-
DIPLOMA MUSIC	5234	-	-	-	-	-
DIPLOMA NURSING	6587	-	-	-	-	-
DIP.PHYS.OCC.THERAPY	5131	-	-	-	-	-
DIP.GEN.SCIENCE	4824	-	-	-	-	-
DIP.NURSING TECH.	7945	-	-	-	-	-
DIPLOMA DENTAL HYG.	8019	-	-	-	-	-
DIP.PUBLIC HLTH.NURSING	4822	-	-	-	-	-
DIP.TECH.COURS.	4251	-	-	-	-	-
DIP.PRELIM. YEAR	5976	-	-	-	-	-
DIP.MED.INTERN-RESID.	0	-	-	-	-	-
OISE						

- d) Honours General Arts - one year General Arts
- e) Honours General Science - one year General Science
- f) Law - two years of Commerce

Tables 15 and 16 list comparable costs of graduate students in the various university programs.

Table 17 describes the student and societal costs by program upon graduation but does not reflect the costs of student attrition. There is a substantial variation among the various programs and it should be noted that the final percentages are a function of

- i) formula weights
- ii) length of program
- iii) foregone earnings

These are definitely not constant across all programs.

It is interesting to note that students in programs leading to "prestigious" occupations pay relatively low proportions of the Societal costs of their education, e.g.

Proportion of Societal Cost  
Borne by Student (%)

Dentistry	-	25.08
Medicine	-	27.39
Law	-	33.98
Vet. Medicine	-	20.24
Pharmacy	-	25.69
Architecture	-	30.31
Nursing	-	27.94

UNIVERSITIES  
INSTITUTIONAL COST PER YEAR PER STUDENT  
BY PROGRAM (GRADUATE)

TABLE 15

PROGRAM NAME	MASTERS		Ph.D		THESIS ONLY
	1 ST YEAR	DIPLOMA	1 ST YEAR	2 ND STAGE	
AGRICULTURE	0	0	10108	15152	2542
ARCHITECTURE	5064	2542	10108	0	2542
COMMERCE	3803	2542	5064	15152	2542
DENTISTRY	0	2542	10108	0	2542
ENGINEERING	5064	2542	10108	15152	2542
FINE & APPLIED ARTS				0	0
FORESTRY	5064	2542	10108	15152	2542
HOUSEHOLD AND FOOD SCI.	5064	0	10108	15152	0
HYGIENE-PUBLIC HEALTH	5064	2542	10108	15152	2542
JOURNALISM	0	2542	0	0	0
LAW	0	0	7586	15152	2542
LIBRARY SCIENCE	3803	0	7586	0	0
PREMEDICINE & MEDICINE	7586	2542	10108	15152	2542
MUSIC	5064	0	10108	15152	2542
NURSING	5064	0	10108	0	2542
PHARMACY	5064	0	10108	15152	2542
PHYSICAL & HEALTH EDUC.	3803	0	7586	0	0
PHYSICAL & OCC.THERAPY	0	2542	0	0	0
SOCIAL WORK	2542	0	5064	15152	2542
VETERINARY MEDICINE	0	2542	10108	15152	0
THEOLOGY	0	0	0	0	0
HON.GEN.ART 1/GEOGRAPHY	2542	0	10108	15152	2542
HON.ART UPPER/HUMANITIES	3803	2542	7586	15152	2542
HON.GEN.SCI. 1/PHYS-BIOL	0	2542	10108	15152	2542
UPPER YRS.HON.SCI/MATH	5064	2542	7586	15152	2542
SECRETARIAL/CHILD STUDY	0	2542	0	0	0
HOSPITAL ADMINISTRATION	0	2542	5064	0	0
LANDSCAPE ARC/PSYCHOLOGY	0	0	10108	15152	2542
PUBLIC ADMINISTRATION	2542	2542	5064	0	2542
DIP.PUBLIC AD/RES SOC.SC.	0	2542	7586	15152	2542
DIPLOMA GENERAL ARTS	0	0	0	0	0
DIPLOMA COMMERCE	0	0	0	0	0
DIPLOMA MUSIC	0	0	0	0	0
DIPLOMA NURSING	0	0	0	0	0
DIPLOMA PHYS.OCC.THERAPY	0	0	0	0	0
DIPLOMA GEN.SCIENCE	0	0	0	0	0
DIPLOMA NURSING TECH.	0	0	0	0	0
DIPLOMA DENTAL HYGIENE	0	0	0	0	0
DIP.PUBLIC HLTH.NURSING	0	0	0	0	0
DIPLOMA TECHNOLOGY COURS.	0	0	0	0	0
DIPLOMA PRELIMINARY YR.	0	0	0	0	0
DIP.MED.INTERN-RESID.	0	0	0	0	0
OISE	5064	0	10108	15152	0

UNIVERSITIES  
 SOCIETAL COST PER YEAR PER STUDENT  
 BY PROGRAM (GRADUATE)

TABLE 16

PROGRAM NAME	MASTERS		Ph.D		THESIS ONLY
	1 ST YEAR	DIPLOMA	1 ST STAGE	2 ND STAGE	
AGRICULTURE	0	0	16767	22576	7716
ARCHITECTURE	9975	9160	17871	0	8820
COMMERCE	12080	10328	13239	24698	9338
DENTISTRY	0	10733	19444	0	10393
ENGINEERING	9798	9160	17871	23680	8820
FINE AND APPLIED ARTS	0	0	0	0	0
FORESTRY	9746	8995	17705	23514	8655
HOUSEHOLD AND FOOD SCI.	13526	0	18889	24698	0
HYGIENE-PUBLIC HEALTH	13539	10178	18889	24698	9838
JOURNALISM	0	6952	0	0	0
LAW	0	0	13030	21738	6879
LIBRARY SCIENCE	8237	0	13581	0	0
PREMEDICINE & MEDICINE	12901	6364	15075	28758	13398
MUSIC	13543	0	18889	24698	9838
NURSING	9822	0	15843	0	6760
PHARMACY	9723	0	17036	22845	7985
PHYSICAL & HEALTH EDUC.	12096	0	15989	0	0
PHYSICAL & OCC.THERAPY	0	6909	0	0	0
SOCIAL WORK	6813	0	11654	23174	8315
VETERINARY MEDICINE	0	6358	15069	26348	0
THEOLOGY	0	0	0	0	0
HON.GEN.ART 1/GEOGRAPHY	10632	0	18889	24698	9838
HON.ART UPPER/HUMANITIES	12082	10178	15989	24698	9838
HON.GEN.SCI 1/PHYS-BIOL	0	10178	18889	24698	9838
UPPER YRS.HON.SCI/MATH	13539	10178	15989	24698	9838
SECRETARIAL CHILD STUDY	0	10167	0	0	0
HOSPITAL ADMIN.	0	10446	13357	0	0
LANDSCAPE ARC/PSYCH.	0	0	18889	24698	9838
PUBLIC ADMINISTRATION	10390	10334	13246	0	9838
DIP.PUBLIC AD/RES.SOC.SCI.	0	10178	15989	24698	9838
DIPLOMA GENERAL ARTS	0	0	0	0	0
DIPLOMA COMMERCE	0	0	0	0	0
DIPLOMA MUSIC	0	0	0	0	0
DIPLOMA NURSING	0	0	0	0	0
DIP.PHYS.OCC.THERAPY	0	0	0	0	0
DIPLOMA GEN.SCIENCE	0	0	0	0	0
DIPLOMA NURSING TECH.	0	0	0	0	0
DIPLOMA DENTAL HYGIENE	0	0	0	0	0
DIP.PUBLIC HLTH.NURSING	0	0	0	0	0
DIP.TECH.COURS.	0	0	0	0	0
DIP.PRELIM.YEAR	0	0	0	0	0
DIP.MED.INTERN-RESID.	0	0	0	0	0
OISE	13339	0	19148	24957	0

UNIVERSITY - UNDERGRADUATE

STUDENT AND SOCIETAL COSTS BY PROGRAM

TABLE 17

PROGRAM NAME	STUDENT COST	SOCIETAL COST	% SOCIETAL COST BORNE BY STUDENT
Agriculture	9,083	33,820	26.85
Architecture	13,495	44,518	30.31
Commerce	9,084	28,021	32.41
Dentistry	13,353	53,238	25.08
Engineering	9,435	34,175	27.60
Fine & Applied Arts	9,097	28,034	32.04
Forestry	9,268	33,965	27.28
Household & Food Science	9,112	33,807	26.95
Journalism	9,151	22,248	41.13
Law	12,230	35,982	33.98
Library Science	9,095	23,655	38.44
Pre-Medicine & Medicine	16,433	59,977	27.39
Music	8,964	33,873	26.46
Nursing	9,577	34,272	27.94
Pharmacy	8,540	33,230	25.69
Physical & Health Ed.	9,160	28,086	32.61
Phys. & Occ Therapy	6,532	19,318	33.81
Social Work	6,592	16,385	40.23
Veterinary Medicine	9,214	45,508	20.24
Theology	6,269	16,060	39.03
Hon Gen.Art 1/Geography	6,575	16,382	40.13
Hon Art Upper/Humanities	8,618	26,580	32.42
Hon Gen.Sci/Phys-Biol.	6,336	16,405	38.62
Upper Yrs. Hon Sci/Math	9,974	35,211	28.32
Secretarial/Child Study	6,631	16,425	40.37
Landscape Arc/Psychology	8,365	34,881	23.98
Dip.Public Ad/Res.Soc.Sci.	1,078	5,019	21.47
Dip. General Arts	1,892	5,123	36.93
Diploma Commerce	1,890	5,121	36.90
Diploma Music	1,903	8,034	23.68
Diploma Nursing	2,003	5,234	38.26
Dip.Phys.Oc.Therapy	1,906	6,587	28.93
Dip.General Sci.	1,900	5,131	37.02
Dip. Nursing Tech.	1,596	4,824	33.08
Dip. Dental Hygiene	1,815	7,945	23.85
Dip. Public Health Nursing	1,889	8,019	23.55
Dip. Technology Course	1,594	4,822	33.05
Dip. Preliminary Year	1,890	4,251	44.46
Dip. Med.Intern-Residents	1,222	5,976	20.44

as compared to the overall university average of about 33% taken from Table 17. The cases of dentistry, medicine and nursing are particularly interesting as the hospital costs associated with these programs have not been included in the societal costs. These costs will be considered in more detail shortly, but for comparative purposes the revised student percentages for these three programs are as follows:

PROGRAM	STUDENT COST	SOCIETAL COST		STUDENT COST PERCENT
		ACADEMIC	HOSPITAL	
Dentistry	13353	53238	46110	13.44
Medicine	16433	59977	43128	15.93
Nursing	9577	34272	6193	23.66

Given the high level of subsidization, it would appear that Society attaches a particularly high value to the services of these graduates.

Table 18 lists the university undergraduate degree or diploma costs in programs for which pass rate statistics were available. The "cost per student" column is the cost of maintaining an average student in the program until graduation, assuming he passes every year, while the "cost per graduate" column reflects the real situation where the student faces the possibility of failure. The final column shows the cost added by failures, transfers etc. to the cost of producing a graduate.

The remaining Tables, 19 through 22, list the institutional and societal costs by program by year for Community Colleges, Teachers' Colleges, Nursing Schools and Agricultural Colleges.

## UNIVERSITY - UNDERGRADUATE

## INSTITUTIONAL DEGREE (DIPLOMA) COSTS BY PROGRAM

PROGRAM NAME	COST PER STUDENT (1)	COST PER GRADUATE (2)	COST OF FAILURES (2-1)
Agriculture	20,256	25,322	5,066
Architecture	25,320	56,130	30,810
Commerce	15,212	43,433	28,221
Dentistry	32,886	42,559	9,673
Engineering	20,256	58,098	37,842
Fine & Applied Arts	15,212	31,127	15,915
Forestry	20,256	38,142	17,886
Household & Food Sci.	20,256	36,256	16,000
Journalism	10,168	19,191	9,023
Law	22,818	34,767	11,949
Library Science	11,429	16,394	4,965
Pre-Medicine & Medicine	35,428	47,204	11,776
Music	20,256	63,877	43,621
Nursing	20,256	55,405	35,149
Pharmacy	20,256	26,553	6,297
Physical & Health Ed.	15,212	46,102	30,890
Physical & Occ. Therapy	10,148	14,286	4,138
Social Work	7,626	10,170	2,544
Veterinary Medicine	30,344	45,978	15,634
Theology	7,626	7,627	*
Hon.Gen.Art 1/Geog.	7,626	18,514	10,888
Hon.Gen.Sci. 1/Phys-Biol	7,626	18,778	11,152
Upper Yrs. Hon.Sci/Math	20,256	35,308	15,052
Secretarial/Child Study	7,626	11,917	4,291
Landscape Arc/Psychology	20,256	39,171	18,915
Hon.Arts Upper/Hum.	13,951	24,426	10,475

COMMUNITY COLLEGESINSTITUTIONAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
3 YR BUSINESS	1732	1732	1732
2 YR BUSINESS	1732	2165	0
1 YR BUSINESS	1732	0	0
3 YR APPLIED ARTS	1732	1732	1732
2 YR APPLIED ARTS	1732	1732	0
1 YR APPLIED ARTS	1732	0	0
3 YR TECHNOLOGICAL	2165	2165	3248
2 YR TECHNOLOGICAL	2165	2165	0
1 YR TECHNOLOGICAL	2165	0	0
APPRENTICESHIP TRAINING	2165	2165	2165
OTHER	1299	0	0
MANPOWER RETRAINING	2165	0	0
BUSINESS	1732	1732	1732
TECHNICAL	2165	2165	3248
ARTS	1732	1732	1732
HEALTH	4330	4330	4330

COMMUNITY COLLEGESSOCIETAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
3YR BUSINESS	3282	3619	3957
2YR BUSINESS	3282	3995	0
1YR BUSINESS	3282	0	0
3YR APPLIED ARTS	3282	3619	3957
2YR APPLIED ARTS	3282	3619	0
1YR APPLIED ARTS	3282	0	0
3YR TECHNOLOGICAL	3658	3995	5273
2YR TECHNOLOGICAL	3658	3995	0
1YR TECHNOLOGICAL	3658	0	0
APPRENTICESHIP TRAINING	3480	3817	4155
OTHER	2735	0	0
MANPOWER RETRAINING	3480	0	0
BUSINESS	3477	3815	4153
TECHNICAL	3853	4191	5468
ARTS	3477	3815	4153
HEALTH	5367	6071	6408

TABLE 20

TEACHERS COLLEGESINSTITUTIONAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
TEACHER TRAINING 1 YEAR	1935	0	0
TEACHER TRAINING 2 YEAR	1935	1935	0
TEACHING UNIVERSITY GRAD.	1935	0	0
PRIMARY SPECIALIST	1935	0	0

TEACHERS COLLEGESSOCIETAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
TEACHER TRAINING 1 YEAR	3481	0	0
TEACHER TRAINING 2 YEAR	3481	3819	0
TEACHING UNIVERSITY GRAD	3481	0	0
PRIMARY SPECIALIST	3481	0	0

NURSING SCHOOLSINSTITUTIONAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
NURSING 2 YR	2296	2296	0
NURSING 2 YR PLUS 1	2296	2296	2296
NURSING 3 YR	2296	2296	2296

NURSING SCHOOLSSOCIETAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
NURSING 2 YR	4811	5148	0
NURSING 2 YR PLUS 1	4811	5148	5486
NURSING 3 YR	4811	5148	5486

TABLE 22

AGRICULTURAL COLLEGESINSTITUTIONAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
AGRICULTURE	4183	4183	0
HOME ECONOMICS	4183	4183	0
ANIMAL HEALTH	4183	4183	0
DAIRY SHORT COURSE 3 MTH	4183	0	0

AGRICULTURAL COLLEGESSOCIETAL COST PER YEAR PER STUDENT BY PROGRAM

PROGRAM NAME	1st YEAR	2nd YEAR	3rd YEAR
AGRICULTURE	5822	6159	0
HOME ECONOMICS	5822	6159	0
ANIMAL HEALTH	5822	6159	0
DAIRY SHORT COURSE 3 MTH	5699	0	0

#### 4.3.2 The Costs of Programs with Hospital Components

Costing programs which use hospital facilities is a difficult procedure at best, and one for which data is poorly organized. The results stated here rely heavily on data obtained from the Ontario Health Services Commission, which listed various program expenditures at the hospitals in Ontario as well as D.B.S. data.

The method employed in this portion of the study is consistent with that used for purely academic programs. More detailed explanations of the methodology are found in volume II, Appendices.

Table 23 shows the institutional and societal costs of the Dentistry program and separates both academic and hospital components. The table further reflects corrections in annual costs per student by year both in the classroom and hospital, based on actual contact-hours.

The profile of contact hours are generated in part A of the table.

The Institutional Cost table (part B) contains the relevant cost statistics for each of the academic years, uncorrected for pass-fail rates. Column 1 lists the academic years and the final "all" row should be interpreted to represent totals. Column 2 represents the classroom or academic costs per year while column 3 represents the hospital component. Column 4 represents the combined classroom and hospital costs. Thus, reading across row 5 it can be seen that there is a \$2,180 per student academic cost, a \$23,119 hospital cost for a combined total in that

# DENTISTRY

## ENROLMENT & CONTACT HOURS

TABLE 23 (A)

Ac. Year (1)	Enrol- ment (2)	Contact Hrs. per Stud.		Total Contact Hours	
		Classroom (3)	Hospital (4)	Classroom (2)x(3)	Hospital (2)x(4)
1	123	N/A	-	-	-
2	123	819	-	100,737	-
3	157	707	104	110,999	16,328
4	130	536	609	69,680	79,170
5	134	160	775	21,440	103,850
6					
All		2,222	1,488	302,856	199,348

## INSTITUTIONAL COST

(B)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	2,542	-	2,542	312,666	-	312,666
2	11,160	-	11,160	1,372,665	-	1,372,665
3	9,634	3,102	12,736	1,512,497	487,070	1,999,567
4	7,304	18,167	25,471	949,475	2,361,671	3,311,146
5	2,180	23,119	25,299	292,146	3,097,884	3,390,030
6	-	-	-	-	-	-
All	32,820	44,388	77,208	4,439,449	5,946,625	10,386,074

## SOCIETAL COST

(C)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	5,131	-	5,131	631,113	-	631,113
2	17,700	-	17,700	2,177,119	-	2,177,119
3	15,280	3,223	18,503	2,398,900	505,967	2,904,867
4	11,584	18,872	30,456	1,505,918	2,453,295	3,959,213
5	3,458	24,015	27,473	463,359	3,218,071	3,681,430
6	-	-	-	-	-	-
All	53,153	46,110	99,263	7,176,409	6,177,333	13,353,742

## DEGREE COST

(D)

Classroom (1)	Hospital (2)	Total (1)+(2)
42,559	57,559	100,118

year of \$25,299. The remaining three columns represent Ontario total costs.

The Societal Cost table (part C) is similar to part B except that it represents societal costs.

The Degree Cost (part D) table represents the expected classroom, hospital and total degree costs modified to reflect pass rates. This degree cost is generated from the average institutional cost per year statistics and represents the average institutional cost of a graduate in this program. The corresponding societal cost would be higher by the ratio of societal to institution costs times the total Degree Costs. The corresponding cost statistics for Dentistry follow

Institutional Degree Cost	100,118
Societal Degree Cost	128,712

A number of graduate programs exist for dentists, ranging from one to three years. Costing these programs is beyond the scope of this work.

Table 24 shows the relevant statistics for Medicine. The table is structurally similar to that for dentistry except two further adjustments are made

- i) there is a year of internship after the sixth year to become a Medical Doctor (M.D.)
- ii) specialists in Medicine may require from one to three years of further hospital training

MEDICINE

ENROLMENT & CONTACT HOURS

TABLE 24 (A)

Ac. Year (1)	Enrol- ment (2)	Contact Hrs. per Stud.		Total Contact Hours	
		Classroom (3)	Hospital (4)	Classroom (2)x(3)	Hospital (2)x(4)
1	229	N/A	-	-	-
2	230	N/A	-	-	-
3	392	1,107	-	433,944	-
4	394	618	224	243,492	88,256
5	375	372	630	139,500	236,250
6	362	126	759	45,612	274,758
All	-	2,223	1,613	862,548	599,264

INSTITUTIONAL COST

(B)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	2,542	-	2,542	582,118	-	582,118
2	2,542	-	2,542	584,660	-	584,660
3	14,828	-	14,828	5,812,502	-	5,812,502
4	8,278	5,766	14,044	3,261,476	2,271,539	5,533,115
5	4,983	16,216	21,199	1,868,545	6,080,887	7,949,432
6	1,688	19,536	21,224	610,954	7,072,052	7,683,006
All	34,861	41,518	76,379	12,720,255	15,424,578	28,144,833

SOCIETAL COST

(C)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	5,176	-	5,176	1,185,304	-	1,185,304
2	5,514	-	5,514	1,268,220	-	1,268,220
3	24,056	-	24,056	4,659,704	-	4,659,704
4	13,430	5,989	19,419	4,703,178	2,359,753	7,062,931
5	8,083	16,845	24,928	4,710,750	6,316,756	11,027,506
6	2,738	20,294	23,032	4,670,162	7,346,368	12,016,530
All	58,997	43,128	102,125	21,197,318	16,022,877	37,220,195

DEGREE COST

(D)

Classroom (1)	Hospital (2)	Total (1)+(2)
47,204	56,218	103,422

The costs statistics for medicine excluding the above two considerations are listed here

Institutional Degree Cost	103,422
Societal Degree Cost	138,275

The costing of internship programs is a difficult exercise. The two antipodal arguments are that

- i) interns' marginal productivity exceeds their cost and as they require no special educational facilities there is no cost to society.
- ii) interns require attention and instruction comparable to that of medical students in their final year. Further, as university graduates their salaries as interns are below those they could earn in the market at some other profession and so there is a cost to society.

The cost and benefit model was not geared to respond to this problem as it is questionable that interns fall into the category of post-secondary students. Probably the truth lies somewhere between these arguments.

The assumption will be made here that the cost of the internship year and each subsequent year of specialist residency are determined at the same rate as the final medical degree year. This assumption yields the following results.

PROGRAM	DEGREE COST	
	INSTITUTION	SOCIETY
M.D.	103422	138,275
M.D. & Intern	124646	161,307
Specialist 1 yr	145870	184,339
Specialist 2 yr	167094	207,371
Specialist 3 yr	188318	230,403

Tables 25 and 26 represent the related cost figures for university nursing and the two year diploma program costs for nursing schools. The university Nursing program also uses hospital facilities and these added costs are reflected in the summary of Degree Costs (part D) of Table 25

#### 4.4 Scale Analysis

No attempt was made to perform a scale analysis on the the institution-specific cost data, as almost all of the costs were distributed among the various programs by operating grant formula weights. The use of the formula as a proxy for a thorough cost accounting analysis precludes obtaining marginal costs as they would, in fact, not vary except in the case of the emerging universities where extra-formula allowances prevail.

ENROLMENT & CONTACT HOURS

TABLE 25 (A)

Ac. Year (1)	Enrol- ment (2)	Contact Hrs. per Stud.		Total Contact Hours	
		Classroom (3)	Hospital (4)	Classroom (2)x(3)	Hospital (2)x(4)
1	341	468	-	159,588	-
2	284	384	164	109,056	46,576
3	271	264	284	71,544	76,964
4	185	144	144	26,640	26,640
5					
6					
All		1,260	592	366,828	150,180

INSTITUTIONAL COST

(B)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	6,984	-	6,984	2,381,536	-	2,381,536
2	5,730	1,652	7,382	1,627,446	469,097	2,096,543
3	3,940	2,860	6,800	1,067,653	775,154	1,842,807
4	2,149	1,450	3,599	397,549	268,309	665,858
5						
6						
All	18,803	5,962	24,765	5,474,184	1,512,560	6,986,744

SOCIETAL COST

(C)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	11,744	-	11,744	4,004,808	-	4,004,808
2	9,636	1,716	11,352	2,736,724	487,227	3,223,951
3	6,625	2,971	9,596	1,795,373	805,114	2,600,487
4	3,614	1,506	5,120	668,522	278,679	947,201
5						
6						
All	31,619	6,193	37,812	9,205,427	1,571,020	10,776,447

DEGREE COST

(D)

Classroom (1)	Hospital (2)	Total (1)+(2)
55,405	17,568	72,973

NURSING - DIPLOMA (2 YEAR)

ENROLMENT & CONTACT HOURS

TABLE 26 (A)

Ac. Year (1)	Enrol- ment (2)	Contact Hrs. per Stud.		Total Contact Hours	
		Classroom (3)	Hospital (4)	Classroom (2)x(3)	Hospital (2)x(4)
1	3,584	528	288	1,892,352	1,032,192
2	2,902	504	480	1,462,608	1,392,960
3	2,381	N/A	N/A	-	-
4					
5					
6					
All	-	1,032	768	3,354,960	2,425,152

INSTITUTIONAL COST

(B)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	-	1,768	1,768	-	6,338,264	6,338,264
2	-	2,947	2,947	-	8,553,591	8,553,591
3						
4						
5						
6						
All	-	4,715	4,715	-	14,891,855	14,891,855

SOCIETAL COST

(C)

Ac. Year (1)	Per Student Cost			Total Cost		
	Classroom (2)	Hospital (3)	Total (2)+(3)	Classroom (4)	Hospital (5)	Total (4)+(5)
1	-	3,822	3,822	-	13,698,048	13,698,048
2	-	6,370	6,370	-	18,485,740	18,485,740
3						
4						
5						
6						
All	-	10,192	10,192	-	32,183,788	32,183,788

DEGREE COST

(D)

Classroom (1)	Hospital (2)	Total (1)+(2)
-	5,183	5,183

#### 4.5 REDISTRIBUTIVE ANALYSIS

The results of the redistributive analysis model indicate the relative contributions of each of the income classes to the costs of post-secondary education and the reallocation of these funds to the students in relation to their participation, by economic income class, in any of the programs. The benefits defined are actually subsidies, as the assumption is made that students would be required to bear the full costs of post-secondary education were it not for the contributions of government, business and private individuals.

There has long been suspicion that public aid to higher education has been regressive in nature. The principle work that has been done prior to this study is that of R. W. Judy. Professor Judy's study used 1961 Canadian data, and he concluded that there was no significant income-redistribution taking place. Since 1961 there have been a number of important developments in post-secondary education which have prompted a re-examination of this question.

Table 27 provides an insight into the nature of provincial population distributions showing the distribution of Ontario post-secondary student population by family income as well as the distribution of all Ontario families by income. Taken together, these data indicate the extent to which the families of post-secondary students in Ontario are "typical" of the general population income classes.

In the overall view of post-secondary institutions in Ontario, it can be seen that the upper income classes, specifically students whose parents earn over \$7,000 a year, as a group receive more benefits than their total contributions to the financing of this education. In effect, the two lower middle income groups, the over \$3,000 to \$7,000 are subsidizing the two upper groups. The lowest income group receives a percentage benefit equal to their cost contributions. Table 28 summarizes these results.

TABLE 27

PERCENTAGE DISTRIBUTION OF ONTARIO  
POST-SECONDARY STUDENT FAMILY INCOME

Under \$3000	\$3000- 4499	\$5000- 6999	\$7000- 9999	\$10000+
6.9	10.6	21.1	26.4	35

PERCENTAGE DISTRIBUTION  
ONTARIO FAMILY INCOME

Under \$3000	\$3000- 4999	\$5000- 6999	\$7000- 9999	\$10000+
8.1	10.4	19.8	29.8	31.8

# INCOME REDISTRIBUTION ANALYSIS

## All Post-secondary Institutions, Ontario

### Income Classes

TABLE 28

COMPONENT	Under \$2,999	\$3,000- \$4,999	\$5,000- \$6,999	\$7,000- \$9,999	\$10,000+
Societal Cost %	8.86	16.58	23.65	22.66	28.25
Student Benefit %	8.98	12.24	19.94	24.93	33.91

In light of the available information it can be concluded that expenditure on post-secondary education is regressive, though not extremely regressive. A precautionary note should be considered in that 1961 tax incidence rates were employed to calculate costs to each income group, while 1968-1969 socio-economic data concerning the composition of post-secondary institutions was used. It may be that the proportionate tax contributions are more progressive than they were in 1961, which would reduce the overall regressivity that has been discovered here.

Table 29 describes the income redistribution effects of expenditure on universities (all programs) and provides the proportional distribution of costs by Federal Provincial government, Student and Rest-of-the-Economy Sectors. Comparing Societal Costs and Student Benefits, by income class, it can be seen that the redistributive effects of university education are slightly regressive. Students whose families earn between \$3,000 and \$7,000 receive less benefits than their total contribution to the costs of education while students whose families earn more than \$7,000 receive a proportionately greater amount.

UNIVERSITIESAGGREGATE REDISTRIBUTIVE ANALYSISCOSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.68	18.32	25.58	21.82	26.60
(2) PROVINCIAL	10.39	20.00	25.53	20.60	23.48
(3) REST OF ECONOMY	5.00	8.00	10.00	25.00	52.00
(4) STUDENT	8.53	11.96	18.15	24.59	36.77
(1 + 2 + 3 + 4) SOCIETAL	9.09	16.74	22.76	22.26	29.15

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	9.36	12.35	18.25	24.41	35.63

The proportional break-down of cost distributions by Federal, Provincial, Rest-of-the-Economy and Student categories provides additional information on the nature of the income redistribution in universities. It is interesting to note that university funds raised through the Provincial tax base are more regressive than the funds derived from Federal Contributions. This result is probably partially due to the sales taxes which tend to be regressive. The Federal component which is relatively progressive is included in the provincial operating grants through a tax sharing agreement.

This study also generated an analysis of the income redistribution aspects of selected programs. Table 30 shows that a substantial variation in redistributive effects exists among programs, with the professional faculties of medicine and law being highly regressive. No less than 49.4 percent of the benefits in the law program go to the upper income groups which bears only 29 percent of the costs. Similarly, over 40 percent of the benefits in the medicine program go to the upper income group. In general, all the selected programs in universities are regressive. The costs are not borne by the "poor", i.e. those with under \$3,000 of family income, but by families in the \$3,000 to \$7,000 income range. The most attractive programs from the viewpoint of lower income group participation are Dentistry, Engineering, Hygiene, Pharmacy, Social Work, General Science, Hospital Administration, Landscape Architecture, Public Administration and the O.I.S.E. programs all of which return at least 10 percent benefit for 9 percent cost contribution.

The pharmacy program appeals most strongly to the \$7,000 - \$9,000 income class families and is, in fact, strongly subsidized by the over \$10,000 income class.

# UNIVERSITIES

## REDISTRIBUTIVE ANALYSIS BY PROGRAM

TABLE 3

	Under \$3000	\$3000- 4999	\$5000- 6999	\$7000- 9999	\$10,000+
SOCIETAL COST	9.09	16.74	22.76	22.26	29.15

## STUDENT BENEFITS

PROGRAM	Under \$3000	\$3000- 4999	\$5000- 6999	\$7000- 9999	\$10,000+
Agriculture	8.25	11.32	18.34	25.01	37.07
Architecture	7.93	10.93	18.43	25.21	37.38
Commerce	8.75	11.80	18.29	24.76	36.37
Dentistry	10.10	10.31	19.96	26.10	33.51
Engineering	11.48	14.96	19.53	24.56	29.44
Fine & Applied Arts	6.89	9.44	18.80	26.29	38.56
Forestry	7.78	10.74	18.47	25.42	37.57
Household & Food Sci.	7.20	10.03	18.62	25.88	38.24
Hygiene - Pub. Health	12.74	16.85	17.16	21.36	31.87
Journalism	7.57	9.98	18.79	26.00	37.72
Law	6.17	6.67	15.54	22.17	49.41
Library Science	9.23	12.40	18.14	24.34	35.89
Pre-Medicine & Medicine	9.02	11.02	15.61	23.95	40.37
Music	7.20	10.03	18.62	25.89	38.23
Nursing	7.17	9.99	18.62	25.89	38.30
Pharmacy	10.07	17.19	23.96	29.38	19.37
Physical & Health Educ.	6.93	9.49	18.78	26.24	38.53
Phys. & Occ. Therapy	9.28	12.47	18.10	24.14	35.99
Social Work	11.12	14.68	17.61	22.59	33.98
Veterinary Medicine	7.84	10.99	18.36	25.19	37.60
Theology	7.45	9.74	18.82	26.06	37.90

TABLE 30 (cont'd)

PROGRAM	Under \$3000	\$3000- 4999	\$5000- 6999	\$7000- 9999	\$10,000+
Hon.Gen.Arts 1/Geog	8.57	11.24	18.45	25.01	36.71
Hon.Gen.Arts Upper/Hum	9.75	13.07	17.95	23.72	35.48
Hon.Gen.Sci. 1/Phys-Biol.	10.26	13.52	17.89	23.40	34.90
Upper Yrs.Hon.Sci/Math	7.62	10.55	18.50	25.49	37.81
Secretarial/Child Study	8.53	11.19	18.46	25.04	36.75
Hospital Administration	12.69	16.79	17.10	21.09	32.29
Landscape Arc/Psychology	12.42	16.46	17.17	21.33	32.60
Public Administration	12.70	16.80	17.10	21.10	32.30
Dip.Public Ad/Res.Soc.Sc.	12.68	16.77	17.10	21.11	32.31
Dip.Gen.Arts	7.26	9.47	18.88	26.26	38.11
Dip.Commerce	7.26	9.47	18.88	26.66	38.11
Dip. Music	6.56	9.24	18.79	26.42	38.96
Dip. Phys.Occ Therapy	6.80	9.32	18.83	26.36	38.67
Dip. Gen. Science	7.26	9.47	18.89	26.26	38.11
Dip. Nursing Tech.	7.26	9.47	18.89	26.26	38.11
Dip. Dental Hygiene	6.56	9.24	18.79	26.42	38.96
Dip. Public Hlth.Nursing	6.56	9.24	18.79	26.42	38.96
Dip. Tech. Courses	7.26	9.47	18.89	26.26	38.11
Dip. Preliminary Year	7.81	9.65	18.96	26.13	37.43
Dip. Med.Intern-Residents	7.80	9.10	15.10	24.79	43.19
OISE	12.70	16.79	17.09	21.10	32.29

REDISTRIBUTIVE ANALYSIS

## (A) Colleges of Applied Arts and Technology

COMPONENT	UNDER \$3000	\$3000 - \$4999	\$5000 - \$6999	\$7000 - \$9999	\$10000 +
Societal Cost	7.95	15.54	28.43	24.18	23.90
Student Benefit	7.48	11.04	31.77	27.13	22.58

## (B) Agricultural Colleges

COMPONENT	UNDER \$3000	\$3000 - \$4999	\$5000 - \$6999	\$7000 - \$9999	\$10000 +
Societal Cost	8.12	16.80	27.94	23.57	23.56
Student Benefit	7.18	10.94	31.74	27.29	22.85

## (C) Teachers' College

COMPONENT	UNDER \$3000	\$3000 - \$4999	\$5000 - \$6999	\$7000 - \$9999	\$10000 +
Societal Cost	9.21	16.49	25.45	24.30	24.55
Student Benefit	10.69	14.22	24.21	26.34	24.54

## (D) Nursing Schools

COMPONENT	UNDER \$3000	\$3000 - \$4999	\$5000 - \$6999	\$7000 - \$9999	\$10000 +
Societal Cost	6.99	16.52	24.47	24.42	27.60
Student Benefit	3.60	11.70	21.70	29.30	33.70

The most neutral program appears to be Engineering which exhibits only mild biases in favour of the under \$3,000 and \$7,000 - \$9,000 income classes.

Table 31 summarizes the income redistribution effects of Community Colleges, Agricultural Colleges, Teachers' Colleges and Nursing Schools. The results indicate that there are, in fact, differences in preference for each of the institution types.

Community Colleges and Agricultural Colleges appear to appeal to similar income strata. The \$5,000 - \$7,000 income classes are subsidized at the expense of the \$3,000 - \$5,000 class.

Teachers' Colleges are relatively neutral with the major benefits going to the under \$3,000 and \$7,000 - \$9,000 classes at the expense of the \$3,000 - \$7,000 income groups. It is perhaps not surprising that the under \$3,000 income class is well represented, due to the characteristics of the program - short duration, social respectability and a relatively secure well-paying job with high vacation privileges.

Nursing Schools, in contrast to the other three institutions appeal most strongly to the over \$7,000 income classes and appear to be the most regressive of the four institutions considered in this table. One possible explanation is that girls faced with the choice of becoming nurses or teachers must decide at least partially on the basis of economic necessity. Nursing typically requires two more years of training, does not have the generous holiday allowances of teaching and pays no more money. The possible attractions of the nursing profession are service to humanity (dedication) or possibly the chance to marry a successful professional. Clearly, a purely economic decision would be a choice of teaching over nursing; so for those who choose the latter, money must not be the primary consideration.

All of the four non-university institution types are relatively less regressive than the university sector. The proportion of their costs and benefits attributable to the upper income group is almost neutral for all but the nursing schools. This relative regressivity of the university sector, may be due to a combination of the various student entrance standards in effect, and the job-training aspects of the non-university sector which matches the motivations of many of the children of lower income families.

Tables 32 to 35 provide a further disaggregation of income redistribution by institution type showing the Federal, Provincial, Rest-of-the-Economy and Student cost and benefit proportions.

COMMUNITY COLLEGES  
AGGREGATE REDISTRIBUTIVE ANALYSIS

COSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.36	18.45	26.39	22.47	25.33
(2) PROVINCIAL	10.40	20.01	25.52	20.59	23.47
(3) REST OF ECONOMY	0.00	0.00	0.00	0.00	0.00
(4) STUDENT	6.7	10.80	31.60	27.60	23.30
(1 + 2 + 3 + 4) SOCIETAL	7.95	15.54	28.43	24.18	23.90

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	7.48	11.04	31.77	27.13	22.58

TABLE 33

TEACHERS' COLLEGESAGGREGATE REDISTRIBUTIVE ANALYSISCOSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.01	18.62	27.31	23.20	23.85
(2) PROVINCIAL	10.20	19.91	25.61	20.71	23.58
(3) REST OF ECONOMY	0.0	0.0	0.0	0.0	0.0
(4) STUDENT	9.90	13.30	24.30	27.00	25.50
(1 + 2 + 3 + 4) SOCIETAL	9.21	16.49	25.45	24.30	24.55

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	10.69	14.22	24.21	26.34	24.54

NURSING SCHOOLSAGGREGATE REDISTRIBUTIVE ANALYSISCOSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.20	18.52	26.80	22.80	24.68
(2) PROVINCIAL	10.29	19.95	25.57	20.65	23.54
(3) REST OF ECONOMY	0.0	0.0	0.0	0.0	0.0
(4) STUDENT	3.60	11.70	21.70	29.30	33.70
(1 + 2 + 3 + 4) SOCIETAL	6.99	16.52	24.47	24.42	27.60

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	3.60	11.70	21.70	29.30	33.70

AGRICULTURAL COLLEGES'AGGREGATE REDISTRIBUTIVE ANALYSISCOSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.02	18.64	27.32	23.21	23.81
(2) PROVINCIAL	10.20	19.91	25.61	20.71	23.56
(3) REST OF ECONOMY	0.0	0.0	0.0	0.0	0.0
(4) STUDENT	6.70	10.80	31.60	27.60	23.30
(1 + 2 + 3 + 4) SOCIETAL	8.12	16.80	27.94	23.57	23.56

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	7.18	10.94	31.74	27.29	22.85

#### 4.6 Benefit Analysis

The benefit analysis differs from the cost and re-distribution analyses in that it includes a large number of parameters whose nature may not be accurately specified. Thus the study takes on an uncertain, predictive quality and it is at this level that simulation capabilities become particularly useful, as various assumptions can be made on the nature of parameter levels, and the sensitivity of the results to parameter changes can be tested.

The following variables could modify the earnings stream and have significant effects on the final results.

- i. taxation rates
- ii. labour force participation
- iii. real economic growth in per capita income
- iv. mortality
- v. ability of the student
- vi. consumption benefits
- vii. migration
- viii. discount rate

##### 4.6.1 Sensitivity Analysis

Although all of the above variables influence the model, it is invalid to attempt wholesale changes without making reasonable assumptions. Because of the difficulty in predicting differences in tax rates, mortality rates and labour force participation rates these variables were not tested to determine their effect on the model. The remaining five variables were investigated, and 10 experiments were run to test the effect of various combinations of these variables on the computational results of the model. The values attached to the test variables in the ten experiments are summerized below, in Table 36

TABLE 36

EXP'T	RATE OF DISCOUNT	ABILITY VARIABLE	CONSUMPTION VARIABLE	GROWTH	MIGRATION
1	0	0	0.1	0	1
2	0	0	0	0	0.9
3	0	0.2	0	0.027	1
4	0	0.4	0	0.027	1
5	0.07	0	0	0.027	1
6	0.07	0.4	0	0.027	1
7	0.10	0.4	0	0.027	1
8	0.10	0.4	0	0.027	1
9	0	0	0	0	1
10	0	0	0	0.027	1

Some discussion must first be given to the range of parameter values:

- i) the discount rate was tested between the extremes of 0% and 10% with an intermediate value of 7%, considered the most realistic estimate.
- ii) the ability variable has been described, in the literature, to vary between 0 and 0.4 (this is the same as attributing between 0% and 40% of the difference in ability to realized earnings). Essentially, this is equivalent to discounting the earnings stream at a rate of from 0 percent to approximately 4.5%. The intermediate value used, 0.2, would discount in the middle of the indicated range (i.e. about 2.5%).
- iii) the consumption variable inflates earnings to reflect non-monetary, "status" benefits of an occupation. These were inferred at two values: 0% and 10%.
- iv) the growth rate variable is indicated in percent per year growth. Two values of growth rate were utilized: 0% and 2.7%. It would be more meaningful to infer a

growth profile over a lifetime with varying rates, made occupation specific, but this was not done as it would constitute a study in itself.

- v) the migration rate was set at only two values, 1.0 which was perfectly neutral, and 0.9 which assumes a 10% net outflow of graduates from the province. (This in fact, is known to be untrue.)

The above discussion is summarized in the following table:

PARAMETER	LOWER BOUND	INTERMEDIATE	UPPER BOUND
Interest Rate	0%	0.07	0.10
Ability	0	0.20	0.40
Non-Pecuniary	0		0.10
Growth Rate	0		0.0273
Migration	0		-0.10

The sensitivity analysis on the ten experiments is summarized in Tables 37 and 38 which describe societal and private rates of return, net present value and benefit-cost ratios for males in selected occupations.

#### Discount Rate

Comparing experiments 5 and 10 (increasing the discount rate from 0% to 7%):

- i) the rate of return is unaffected.
- ii) the societal and private net present values are drastically reduced.
- iii) the benefit-cost ratio is reduced by approximately a factor of from 4 to 5.

# SOCIETAL RETURNS TO POST SECONDARY EDUCATION

## MALES

TABLE I

INDICATOR	EXPERIMENT	AGRIC.	ARCH.	ENG.	MED.	PHARM.	OTHER
RATE OF RETURN  R/R	1	8.22	5.30	4.78	10.30	8.29	4.4
	2	1.39	3.07	2.28	7.88	4.56	1.0
	3	6.85	6.54	5.85	11.29	8.90	5.6
	4	5.69	6.07	5.30	10.50	8.43	5.3
	5	7.98	7.04	6.37	12.18	9.38	6.0
	6	5.69	6.07	5.30	10.50	8.43	5.3
	7	7.98	7.04	6.37	12.18	9.38	6.0
	8	5.69	6.07	5.30	10.50	8.43	5.3
	9	5.15	4.26	3.57	9.17	6.50	3.2
	10	7.98	7.04	6.37	12.18	9.38	6.0
NET PRESENT VALUE  NPV	1	88,305	99,482	68,912	394,346	119,573	62,98
	2	10,165	50,646	28,144	270,119	55,670	23,03
	3	96,603	183,934	125,246	647,042	185,434	118,11
	4	74,611	165,466	110,216	578,105	171,274	108,58
	5	2,212	- 3,046	- 6,704	80,751	13,121	- 8,99
	6	- 8,446	-11,015	-13,173	50,300	6,646	-13,11
	7	-10,565	-22,163	-19,789	16,819	- 6,353	-21,64
	8	-17,567	-27,144	-23,852	- 1,834	-10,479	-24,24
	9	49,235	75,064	48,528	332,232	87,621	43,01
	10	120,062	204,028	141,559	725,629	200,311	128,16
BENEFIT COST RATIO  B/C	1	3.26	2.94	2.74	6.16	4.10	2.54
	2	1.26	1.99	1.71	4.53	2.44	1.56
	3	3.47	4.59	4.17	9.47	5.81	3.88
	4	2.91	4.23	3.79	8.56	5.44	3.65
	5	1.06	.94	.83	2.06	1.34	.78
	6	.78	.78	.67	1.66	1.17	.68
	7	.73	.57	.50	1.22	.84	.47
	8	.55	.47	.40	.98	.73	.41
	9	2.26	2.47	2.23	5.35	3.27	2.05
	10	4.07	4.98	4.58	10.49	6.20	4.13

MALES

TABLE 38

INDICATOR	EXPERIMENT	AGRIC.	ARCH.	ENG.	MED.	PHARM.	OTHER
RATE OF RETURN  R/R	1	42.80	14.59	15.60	29.69	32.20	11.89
	2	14.76	9.63	8.95	20.60	15.90	6.84
	3	26.70	13.40	13.30	24.86	24.04	11.09
	4	22.59	12.38	12.00	22.38	22.20	10.30
	5	31.20	14.50	14.76	27.83	26.10	11.79
	6	22.59	12.38	12.00	22.38	22.20	10.30
	7	31.20	14.50	14.76	27.83	26.10	11.79
	8	22.59	12.38	12.00	22.38	22.20	10.30
	9	28.00	12.18	12.28	24.90	23.20	9.40
	10	31.20	14.50	14.76	27.83	26.10	11.79
NET PRESENT VALUE  NPV	1	95,627	102,278	75,409	319,487	116,169	69,908
	2	28,371	62,373	41,480	224,457	62,643	36,468
	3	82,543	137,290	98,553	424,269	137,830	93,553
	4	65,131	123,839	87,291	377,095	127,120	86,355
	5	22,200	19,587	13,688	86,792	27,856	10,075
	6	13,406	13,437	8,560	64,625	22,722	6,813
	7	13,038	6,919	4,827	46,601	14,796	1,508
	8	7,180	2,988	1,535	32,636	11,458	- 586
	9	61,999	82,325	58,445	271,972	89,406	53,188
	10	101,115	151,926	110,777	478,046	149,082	101,134
BENEFIT COST RATIO  B/C	1	11.20	8.37	8.75	19.80	14.19	6.57
	2	4.03	5.50	5.26	14.20	8.11	3.91
	3	9.81	10.89	11.13	25.96	16.65	8.46
	4	7.95	9.92	9.97	23.18	15.44	7.89
	5	3.37	2.41	2.41	6.11	4.16	1.80
	6	2.43	1.97	1.88	4.80	3.58	1.54
	7	2.39	1.50	1.50	3.74	2.68	1.12
	8	1.77	1.22	1.16	2.92	2.30	.95
	9	7.62	6.93	7.01	17.00	11.15	5.24
	10	11.79	11.95	12.38	29.12	17.93	9.06

Clearly this is a very sensitive variable.

#### Ability Variable

Comparing experiments 4 and 10 (increasing discounting for ability from 0 to a maximum of 40%)

- i) the rate of return is reduced about 30% (both societal and private).
- ii) the net present value is reduced about 38%.
- iii) the benefit-cost ratio is reduced about 30%.

#### Consumption Variable

Comparing experiments 1 and 9 (increasing consumption from 0 to 10%):

- i) the rate of return is increased about 25%.
- ii) the net present value is increased about 25%.
- iii) the benefit-cost ratio is increased about 20%.

#### Growth Variable

Comparing experiments 9 and 10 (increasing the growth rate from 0% each year to 2.7% each year):

- i) the rate of return is increased about 35%
- ii) the net present value is increased by a factor of around 1.5 to 2.0.
- iii) the benefit-cost ratio is increased by a factor of around 1.5 to 2.0.

#### Migration Variable

Comparing experiments 2 and 9 (reducing inflow from neutral to minus 10%):

- i) the rate of return is reduced by about 30%.

SENSITIVITY ANALYSIS

TABLE 39

VARIABLE	EXPTS	CHANGE	R/R	NPV	B/C
Discount Rate	5/10	+ 7%	0	-M	-400%
Ability	4/10	+40%	-30%	-38%	- 30%
Consumtpion	1/9	+10%	+25%	+25%	+ 20%
Growth Rate	9/10	+2.7%	+35%	+250%	+200%
Migration	2/9	-10%	-30%	- 25%	- 15%

- 10
- ii) the net present value is reduced by about 25%.
  - iii) the benefit-cost ratio is reduced about 15%.

Although the sensitivity analysis is superficial and its results should be discounted accordingly, it does provide a rough measure of the sensitivity of parameters in the benefit model. These results, summarized below in Table 39, show that the model is reasonably sensitive to all variables but highly sensitive to the growth variable.

#### 4.6.2 Analysis of Benefits under Normal Assumptions

In the preceding section the benefit model was applied to a small number of post-secondary programs and tested for parametric changes. Next, the model is operated for a large number of programs and under a standard set of "normal" assumptions. These assumptions, which are the "most reasonable" set of assumptions about the model are:

- 1) Discount rate - 0.070
- 2) Ability Factor - 0.200
- 3) Growth Rate - 0.027
- 4) Transitions in-out of province are neutral.

In addition, the model contains a set of assumed parameters on tax base, labour force participation and mortality. These are described in detail in the Appendix Section of the Report.

Private and societal returns for males and females are described on Tables 40 and 41. From the information, three conclusions may be drawn.

## ANALYSIS OF RETURNS BY PROGRAM

Males, Selected Occupations

OCCUPATION	PRIVATE			SOCIETAL		
	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO
Dentistry	56.50	95,348	8.14	19.59	103,646	2.95
Vet. Medicine	36.57	35,291	4.83	9.84	16,731	1.37
Social Work	30.53	8,455	2.28	9.73	3,346	1.20
Agriculture	27.55	17,938	2.97	8.03	2,047	1.06
Medicine	25.45	75,551	5.60	13.11	81,020	2.35
Pharmacy	24.73	25,492	3.99	9.96	15,137	1.46
Law	20.60	45,789	4.74	12.74	49,417	2.37
Library Science	14.08	11,364	2.25	8.52	5,183	1.22
Commerce	14.04	11,855	2.31	7.75	1,833	1.07
Forestry	14.00	11,829	2.28	6.71	-3,966	0.88
Architecture	13.65	16,769	2.24	8.03	2,047	1.06
Engineering	13.59	11,307	2.20	6.56	-4,732	0.86
Journalism	11.52	7,625	1.83	7.71	1,449	1.07
Physical Occ. Therapy	0.74	-5,717	0.12	*	-17,711	0.08
Nursing	*	-13,157	-0.37	*	-58,215	-2.62
Theology	*	-39,055	-5.23	*	-38,986	-0.14

## Assumptions:

Discount Rate - 7%

Growth Rate - 2.7%

Ability Factor - 0.2

Transitions - Neutral

TABLE 41

## ANALYSIS OF RETURNS BY PROGRAM

Female, Selected Occupations

OCCUPATION	PRIVATE			SOCIETAL		
	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO	RATE OF RETURN	NET PRESENT VALUE	BENEFIT COST RATIO
Social Work	161.99	74,421	12.29	47.63	81,430	5.97
Vet. Medicine	87.24	82,318	9.93	18.55	69,906	2.54
Dentistry	85.46	132,793	10.94	26.17	144,062	3.71
Physical Occ Therapy	56.32	13,468	8.06	16.54	12,908	2.96
Agriculture	49.32	46,585	6.13	15.12	31,213	1.92
Medicine	42.98	104,208	7.34	17.20	105,180	2.75
Forestry	34.37	36,571	4.95	12.44	23,524	1.69
Engineering	30.76	32,476	4.44	11.47	18,701	1.55
Library Science	29.65	30,320	4.33	14.44	23,223	1.98
Architecture	24.76	37,036	3.74	10.87	21,295	1.48
Pharmacy	23.80	22,048	3.58	8.13	2,444	1.07
Law	16.08	19,006	2.55	7.69	1,107	1.03
Theology	15.74	5,321	1.85	3.75	-4,339	0.73
Nursing	11.47	4,396	1.46	1.78	-18,294	0.47
Journalism	11.60	4,347	1.48	4.38	-7,179	0.68
Commerce	5.00	-3,195	0.65	1.19	-20,554	0.27

## Assumptions:

Discount Rate - 7%

Growth Rate - 2.7%

Ability Factor - 0.2

Transitions - Neutral

- a) There is a substantial variation between male and female returns. This variation may be explained by traditional discrimination against women in the labour market (this is not constant across all professions), and lower female opportunity costs in the form of female high school earnings.
- b) Societal and private returns differ - as, of course, the societal and private cost components of the respective computations are substantially dissimilar.
- c) Program rankings for either private or societal returns differ for each of the three resources of returns in rate of return, net present values, and benefit-cost ratios. This finding may be explained by the different techniques used to compute each of the three measures of returns.

Of the three measures, perhaps the net present value is the most generally accepted index of success. On this criterion, the top ten programs for males, in terms of private returns are:

PROGRAM	NET PRESENT VALUE
1. Dentistry	95,348
2. Medicine	75,551
3. Law	45,789
4. Veterinary Medicine	34,291
5. Pharmacy	25,492
6. Agriculture	17,938
7. Architecture	16,769
8. Commerce	11,855
9. Forestry	11,829
10. Library Science	11,364

#### 4.6.3 Labour Force Participation of Nurses

Nursing, like most categories of labour, is characterized by less than full participation of its members in the active labour force. This question of labour force participation is particularly important to the benefit study as all non-participating (or unemployed) members of the labour force are neither receiving full economic benefit from their education personally nor making a concomitant economic contribution to society.

The general objectives of this section are:

- 1) to explain the nature and meaning of female labour force participation rates.
- 2) to examine and evaluate the existing data on nursing labour force participation rates.
- 3) to construct a labour force participation profile for female nurses.

In general, either supply or demand factors explain labour force participation. The influence of demand is obvious; if demand for labour in a specific market (or in the whole economy) is low, then employment opportunities are limited and even if individuals seek work, they may not find it.

The influence of supply factors on labour force participation is much more subtle, and this is especially true for the females for whom competing activities such as marriage and child-bearing play a significant role.

A number of studies have been designed to investigate female labour force participation in

Canada<sup>E-135,6</sup> and these studies show that the participation rates of females in the labour force are related to age, marital status, number and age of children, education, husband's salary and family assets and regional location. Furthermore, each of these factors may have a different effect on labour force participation at different periods of time. For example, labour statistics indicate that during the past eighty years, there has been a secular increase in female labour force participation, as social and economic restrictions to females in the labour force have been relaxed.

Figure 5 below, describes the labour force participation schedule for all females in Ontario, by age, for 1966. This is an aggregate schedule and has been influenced by the entire set of labour force participation determinants.

A number of inferences may be made from the information shown on figure 5.

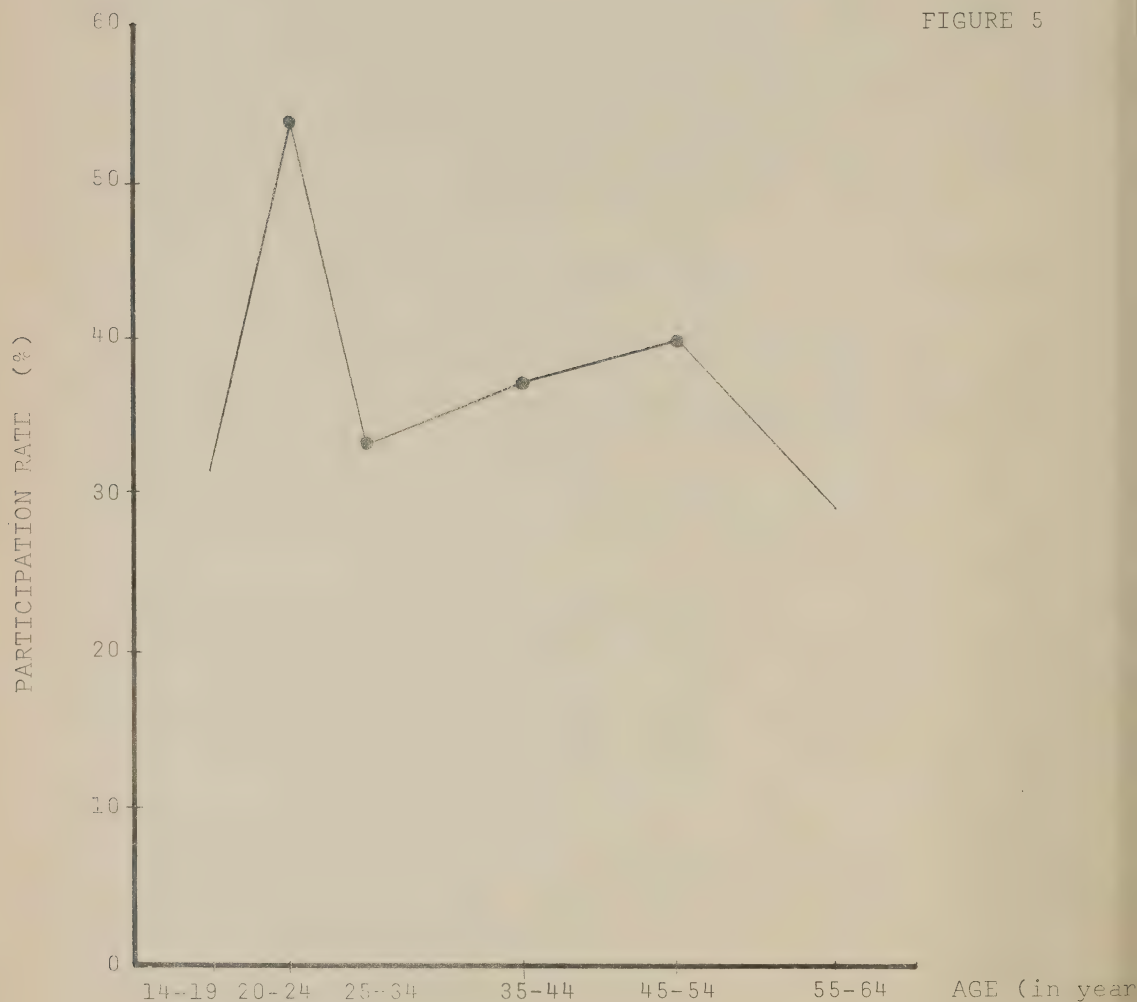
- a) Aggregate female labour force participation rises from a low of 30% for the 14-19 year age cohort, to a peak of 53% for the 20-24 year age cohort. This represents the increasing proportion of women which enter the labour force after completion of schooling.
- b) From the 20-24 to the 25-34 age cohorts, a sharp drop in labour participation occurs, as an increasing proportion of women marry, bear children and leave the labour force. Beyond the 25-34 age levels, the labour force participation schedule tends upwards as women re-enter the labour force as their children become more independent. This trend is reversed at the 45-54 age level as women begin to retire from the labour force.

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E-135 Married Female Labour Force Participation: A Micro Study, Cat. No. 71-516, DBS, 1970.

E-136 Changing Patterns in Women's Employment, Cat. No. L38-2366, Women's Bureau, Canada Department of Labour, Ottawa, 1966.

LABOUR FORCE PARTICIPATION RATES, ALL FEMALES, ONTARIO 1966



Source: F-18 Seasonally Adjusted Labour Force Statistics,  
January 1953 - December 1969, Cat.No. 71-201.  
DBS, 1970

LABOUR PARTICIPATION RATES, OF NURSES,  
FULL-TIME EMPLOYMENT BY AGE

TABLE 42

Age Cohort	All Nurses	Married Nurses	Single, Divorced Widowed Nurses
30-34	21.4	14.7	88.9
35-39	20.2	12.8	69.4
40-44	24.0	17.2	75.0
45-49	31.4	17.1	82.1
50-54	58.8	45.5	80.0

Source: E-137 Survey of Ontario Nurses, Mobility, Services and Attitudes of Active and Inactive Nurses: A preliminary Report, (Unpublished), Ontario Department of Health, Toronto, January 1968

PART-TIME EMPLOYMENT  
OF MARRIED NURSING GRADUATES, BY AGE

TABLE 43

	AGE COHORT			
	30-34	35-39	40-44	45-49
Proportion in Part-time Employment	30.4	21.3	21.5	21.7

The nursing component is a unique sub-sector of female labour supply. Nurses have a unique education which in turn affects their marrying age, the probable size of their family's assets and their perceptions on the desirability of remaining in work after marriage and childbearing. Table 42 provides a summary of sample data on both labour force participation of nurses in Ontario, for both married and single nurses.

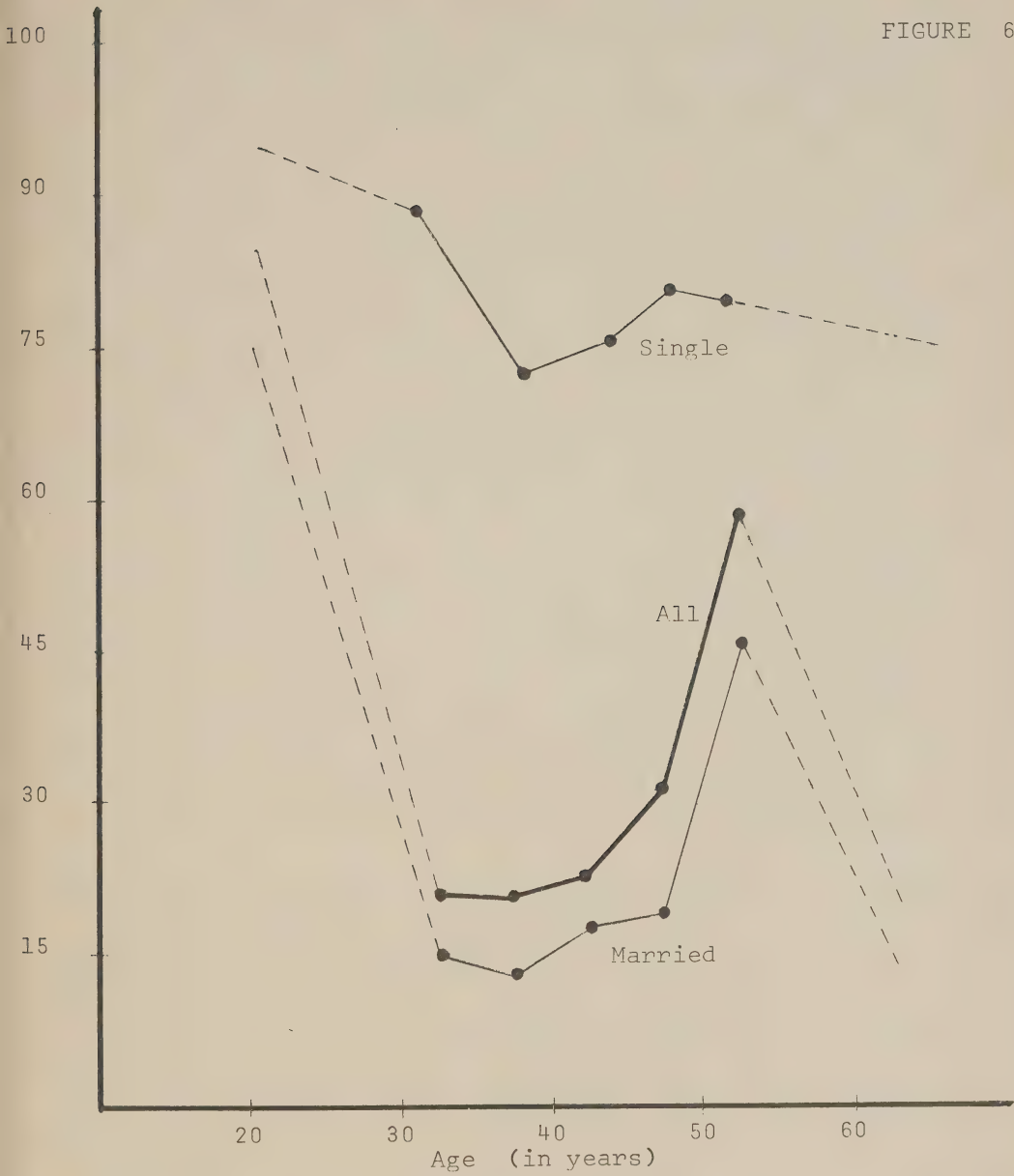
The data in the area of labour force participation of nurses by marital status is sketchy at best. The most complete set of data which was available came from a survey done in 1968 by the Ontario Department of Health.<sup>E-137</sup>

This data is incomplete and somewhat inconclusive since it is based on a small sample of approximately 950 nurses. Also, only nurses between the ages of 30 and 55 have been surveyed. Despite these weaknesses, the survey data does illustrate some interesting characteristics of labour force participation of nurses.

- 1) As should be expected, unmarried nurses have a much higher probability of being employed than do married nurses. The participation rate for unmarried nurses varies between 89% and 70%, while the rate for married nurses varies between 13% and 46%.
- 2) Labour force participation schedules for married, single and "all" nurses have been constructed from weighted averages of the married and unmarried schedules. It shows that overall only 20% of the nurses in the 35-39 year age cohort are employed. However this rate increases for each successive age cohort until it reaches its peak of 56% for the 50-54 year age cohort.

HYPOTHETICAL LABOUR FORCE PARTICIPATION SCHEDULE, ALL NURSES

FIGURE 6



It is difficult to make substantial inferences from the small data sample of this survey. However, if the survey data is accepted, it indicates that while nurses exhibit lower labour force participation characteristics than the norm for females, they tend to return to their profession at later stages of their lives.

The Ontario Survey of Nurses provides one further interesting item of information. It shows that a substantial proportion of married nursing graduates are employed in a part-time capacity, long after graduation. This data is summarized on Table 43. From the standpoint of the benefit model, part-time labour force participation of nurses can be considered as a partial private and social return to education in nursing.

From the two separate sets of information collected on all-female and nursing labour force participation, and with the addition of a number of assumptions, a hypothetical labour force participation schedule was constructed for all nurses over the entire 20-60 year age span. This is shown on Figure 6 and contains the following assumptions:

- a) Over the 20-30 age range the participation rate is assumed to fall from a high of 85% (participation at graduation) to a low of 21%. That is, an 85% participation rate is assumed for nurses at time of graduation and that nurses leave their profession at a constant rate between the ages of 20 and 30. The participation rate for age 30 is given by the Ontario Survey of Nurses.
- b) Beyond the 30-34 year age cohort the participation rate which has been derived from the 1968 Ontario Survey of Nurses (E-137).

The new labour force participation schedule for nurses shows that the profile used in this study was too high (ranging linearly from 54% at ages 20 - 24 to 30% at ages 55-64). This means that in general and for married nurses, the benefit statistics are too high while for single nurses they are far too low.

#### 4.7 Removal of Research Costs from Universities

Although sponsored research costs have been removed as thoroughly as possible from the cost analysis of universities there is still a large component of monies devoted to research implicitly through university staff appointments where time is allocated for research for various reasons - to keep professors abreast of their fields, to improve course content, to train graduate students, to enhance the prestige of the institution, etc.

This section of the report analyses the effects of removing first 25% and then 50% of expenditures on university research. The rationale behind the choice of these somewhat arbitrary amounts is that the average undergraduate teaching load is approximately 3 undergraduate courses plus preparation time. The balance of time is devoted to research. The courses and preparation typically consume 20 to 30 hours of the teaching week, leaving approximately 10 to 20 hours for research. The mixed graduate and undergraduate teaching load is typically one UG, one G course, thesis supervision and the balance research. From these general guidelines it would appear that 25% and 50% are reasonable limits on the research expenditures.

Table 44, below, outlines the changes in total costs due to the removal of research costs at the 25% and 50% levels.

TOTAL COSTS IN MILLIONS OF DOLLARS

	INST	STUD	GOVT	REST	SOCIETY
BASE CASE	427.54	267.27	520.76	16.17	804.2
25% RESEARCH	368.87	252.54	401.91	12.58	667.03
50% RESEARCH	246.61	237.80	283.80	9.0	530.16

TABLE 44

PER CENT BY COLUMN

	INST (0)	STUD (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
BASE	100	100	100	100	100
25%	86	94	77	78	83
50%	58	89	55	56	66

It can be seen that Government and Rest of the Economy costs are reduced almost in direct proportion to the research costs except for those components depending on opportunity costs. The Institutional, Student and Society cost reductions are not in proportion due to components not affected by research expenditures. The universities have large holdings in land and buildings and the opportunity costs on these are not affected by research allocations except perhaps in the case where sales of unneeded research facilities occur. The student's costs are least affected because most of his costs (80%) are in the form of foregone earnings and Societal cost variation reflects the student cost contribution. Table 45 and 46 reflect somewhat more detailed cost figures. It should be pointed out that all of the very specific cost figures (e.g. by program by year, degree costs) are affected by a corresponding amount.

The following tables 47 and 48 indicate the re-distribution which occurs when research costs are excluded. It should be pointed out although the results indicate a very slight shift to a more progressive re-allocation of benefits this effect is probably strongly understated due to the fact that most research money goes

UNIVERSITY - 25% Research1968-69 TRIAL BALANCE AGGREGATE(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	298.06	39.67	308.98	12.13	360.78
Opportunity Costs	70.81	212.87	92.93	.45	306.26
Total Costs	368.87	252.54	401.91	12.58	667.03

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	80.8	15.71	76.88	96.42	54.09
Opportunity Costs	19.2	84.29	23.12	3.58	45.91
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	11.0	85.64	3.36	100
Opportunity Costs	-	69.51	30.34	.15	100
Total Costs	-	37.86	60.25	1.89	100

UNIVERSITY - 50% Research  
1968-69 TRIAL BALANCE AGGREGATE

(A)  
EXPENDITURES IN MILLIONS OF DOLLARS

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	199.40	25.80	213.10	8.66	247.56
Opportunity Costs	47.21	212.00	70.26	.34	282.60
Total Costs	246.61	237.80	283.36	9.00	530.16

(B)  
PER CENT EXPENDITURES BY COLUMN

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	80.86	10.85	75.20	96.22	46.70
Opportunity Costs	19.14	89.15	24.80	3.78	53.30
Total Costs	100	100	100	100	100

(C)  
PER CENT EXPENDITURES BY ROW

	INST (0)	STUDENT (1)	GOVT (2)	REST (3)	SOCIETY (1+2+3)
Direct Costs	-	10.42	86.08	3.50	100
Opportunity Costs	-	75.02	24.86	.12	100
Total Costs	-	44.85	53.45	1.70	100

TABLE 47

UNIVERSITY (25% Research)  
AGGREGATE REDISTRIBUTIVE ANALYSIS

COSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.66	18.32	25.62	21.85	26.55
(2) PROVINCIAL	10.38	20.00	25.53	20.60	23.49
(3) REST OF ECONOMY	5.00	8.00	10.00	25.00	52.00
(4) STUDENT	8.59	12.02	18.14	24.54	36.72
(1 + 2 + 3 + 4) SOCIETAL	9.06	16.41	22.42	22.42	29.68

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	9.55	12.41	18.27	24.37	35.40

UNIVERSITY (50% Research)  
AGGREGATE REDISTRIBUTIVE ANALYSIS

COSTS

COMPONENT	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
(1) FEDERAL	7.62	18.33	25.70	21.92	26.43
(2) PROVINCIAL	10.38	19.99	25.53	20.60	23.50
(3) REST OF ECONOMY	5.00	8.00	10.00	25.00	52.00
(4) STUDENT	8.65	12.09	18.12	24.48	36.66
(1 + 2 + 3 + 4) SOCIETAL	9.02	15.91	21.91	22.66	30.49

BENEFITS

	UNDER \$3,000	\$3,000 - \$4,999	\$5,000 - \$6,999	\$7,000 - \$9,999	\$10,000 +
STUDENT	9.91	12.52	18.31	24.29	34.96

to graduate programs which are relatively more regressive and the model does not have the capability at this time of selectively channeling funds among undergraduate and graduate programs.

The benefit analysis was not drastically affected. The changes brought about in the student cost and societal cost statistics influenced the benefit-cost ratios, net present values and rates of return by corresponding amounts. All of the benefit statistics, increased by the relative ranking of benefits among the programs, remained the same.

## 5. LIMITATIONS OF THE MODEL AND RECOMMENDATIONS FOR FURTHER WORK

### 5.1 Cost Analysis

The cost analysis done to date has been on the basis of aggregate data gathered at central agencies like the Department of University Affairs and the Department of Education. Presumably, much more relevant and detailed information could be obtained by visiting institutions. Conceptually it is felt that the Trial Balance format is sound although more effort could be expended to allocating the costs incurred in fiscal time periods to the appropriate time spans. The following improvements should be made in the model:

- i. a more precise academic year costing on all program which would reflect the actual "contact-hours" spent by students in each of the various years. This would partially offset the necessary default of using formula weights to distribute most of the costs and would contribute to making a meaningful scale analysis possible.
- ii. a clearer definition and differentiation between monies actually received or spent and funds committed. For example, are capital grants all spent in the year they are given or is there a carry-over into subsequent years?
- iii. a review of all expenditure and cost categories to ensure that they have been properly defined and that further disaggregation is not necessary.
- iv. better information on individual institutions reflecting
  - a. accurate cost data by program, college and institution
  - b. correct pass-fail rates. These have a very significant effect on estimating the costs of graduates and hence the costs of failures

- c. better formula weighting schemes based on actual costs.
- v. a scale analysis to investigate the important factors determining costs at the institutions so that marginal cost curves could be generated.

## 5.2 Redistributive Analysis

The income redistributive model is dependent for its accuracy on the general data base established for the cost model. However, there are certain data deficiencies, which particularly affect the redistributive model and these will be discussed here. The major deficiencies consist of the obsolescence or age of several data sources as well as the unavailability of others. Suggestions for improvements are

- i. a more detailed study should be done to determine the socio-economic strata composition of students' parents based not only on earnings (as was done in this phase) but also on educational attainment and occupations.
- ii. this study depended on the use of 1961 data for the incidence of Federal and Provincial Tax rates. These figures should either be updated for further study or new data should be obtained. The tax incidence rates on the general revenue base are better, being for 1966, but the general government revenue figures for 1968-69 should be incorporated.
- iii. the socio-economic composition of students in post-secondary programs should be determined through a more detailed analysis of data available at D.B.S. Also, for the Community Colleges, use should be made of socio-economic data being collected for the Board of Education (although the extent to which this could be done is yet to be determined).
- iv. general changes should be made in breaking out each category of the Trial Balance sheet. These would involve the exact breakout of contributions between Federal

and Provincial funds, socio-economic data on OSAP and OGF funds distribution and tax incidence on private gifts which were estimated for this phase.

### 5.3 Benefit Analysis

This section of the study provided statistics on the returns to graduates of post-secondary institutions. The data requirements for the benefit model are perhaps the most difficult to obtain of any of the sections and it is for this reason that the full potential of analysing returns to all post-secondary students (including drop-outs and graduate students) was not realized. The following tasks should be performed to enhance the power of the model:

- i. improving the existing data base on post-secondary (first-degree/diploma) graduates and including data on graduate students and dropouts so that analyses could be performed for all categories of students.
- ii. in particular, improving the earnings data for at least the university graduates and obtaining data for Community College, Agricultural College, Teachers' College and Nursing School graduates possibly through a survey.
- iii. a dispersion analysis was not done in which the graduates of specific post-secondary programs flow into various occupations. This restricts the graduates of say, engineering to remain in engineering and it is known that this is untrue. Provision was made for such an analysis in the model but the data was not available.
- iv. various educational funding schemes could be tested, (for example having the student pay the full costs of education) and noting the impact these would have on the measures of benefit. Undoubtedly, some effects would also be indicated in the income redistribution portion of the model.

- v. a production function could be derived to define a student's probability of success in post-secondary education on the basis of such variables as his ability, family background, institutional expenditures, student-faculty ratios, etc. The benefit statistics could thus be decomposed not only on the basis of sex but also by socio-economic background and type of institution.

#### 5.4 Conclusions

What this study has shown may be summarized in the following comments:

1. That a consistent methodological approach can be formulated to generate comparative cost, redistribution and benefit statistics on post-secondary education in Ontario.
2. That although the hypothesis that post-secondary education is "regressive" appears true, the degree of regressivity is probably much lower than was generally believed.
3. That post-secondary education has generally been beneficial in economic terms for at least the university graduates (for which most of the reliable data was available) and that choice of program had a very strong influence on the economic returns.

6. GLOSSARY

Because the models developed for this study are based on economic theory and contain a number of terms which may be unfamiliar to the non-economist, this glossary has been prepared to explain a number of the more technical terms. The glossary is written in 'prose style' so that the definitions of the selected terms are contained in a short, logically consistent set of descriptive paragraphs.

The selected technical terms are listed below; the number(s) beside each term refer(s) the reader to a line within the prose glossary, containing that particular term.

<u>t e r m</u> :	<u>l i n e</u> <u>no(s)</u> :
benefit-cost ratio	(132, 134)
demand	(4)
discount rate	(142)
economies of scale	(172)
efficiency in resource allocation	(48, 68, 101)
elasticity of demand	(16)
equitable distribution of income	(102, 123)
external diseconomies	(87, 91, 97, 115)
external economies	(91, 96)
externalities	(81, 104, 109)
growth	(54)
labour market	(26, 33)
monopolistic competition	(64, 66)
monopoly	(58, 60)
monopsony	(39, 44)
net present value	(133, 151, 159, 165)
neutral	(127)
oligopoly	(62, 66)
perfect competition	(57)
profit	(137)
progressive	(125)
rate of return	(132, 169)
regressive	(124)
supply	(7)
taxation	(120)
time preference	(154)

## GLOSSARY OF TECHNICAL TERMS

1           In our free enterprise economic system, most resource  
2 allocation decisions are determined on markets. Here, buyers  
3 of commodities come into contact with sellers. In economic theory  
4 the demand curve (schedule) is an expression of buyers' willingness  
5 to buy a particular product or service and the schedule explicitly  
6 shows the total amount of the product which all buyers would be  
7 willing to buy at each price. The supply curve (schedule) on the  
8 other hand describes the amounts of a particular product which  
9 sellers would be willing to offer for sale at all prices. Obviously  
10 the higher the price, the more of a product would sellers seek to  
11 offer for sale and the less would buyers demand. Given these  
12 relationships between demand, supply, prices and outputs, it is  
13 clear that in product-markets there is a price which "uses-up" all  
14 of the consumer-demand and producer-supply.

15           One method of describing demand schedules is by their  
16 elasticity. This term refers to the degree to which the total  
17 market demand for a product will respond to a given change in price.  
18 If a product has many substitutes (e.g. specific food products  
19 such as bacon and lamb) then a small increase in price may  
20 have a large affect on the quantity demanded and the demand  
21 schedule is described as elastic. If on the other hand, the  
22 product has few substitutes (e.g. cigarettes and liquor) then its  
23 demand schedule may be inelastic as an increase in price hardly  
24 affects the quantity demanded.

25           In economics, labour is treated as a commodity which may  
26 be bought and sold on a labour market. This market is described  
27 as a place where the users of labour, businesses and other producing  
28 entities, set up a demand for labour where the offer-price (wage)  
29 is related to the productivity of that labour in productive use,  
30 and the suppliers of labour offer their services at wages  
31 determined by their need for income relative to their desire  
32 for leisure.

33 The labour market may be subdivided for different types  
 34 of labour. Doctor's services are sold on a very specialized  
 35 market; there are obvious barriers to entry of say plumbers  
 36 into the medical services market. Often these barriers may be  
 37 attributed to real differences in knowledge based on differences  
 38 in training and schooling while in other circumstances, the barriers  
 39 are erected by monopsonies, or formal institutional restrictions  
 40 such as labour unions or professional associations. The key  
 41 element to restriction of labour competition is the maintenance  
 42 of entrance barriers; a fraudulent medical practitioner can be  
 43 prosecuted while anyone can enter employment as a white collar  
 44 worker. Both monopsonies and specific educational training can  
 45 affect a labour market by affecting the supply curve and thereby  
 46 affecting wages.

47 One of the basic articles of faith in economic science  
 48 is that efficiency in resource allocation comes about as natural  
 49 consequence of the free enterprise system. That is, (land, labour  
 50 and capital) in the frictionless, mobile, profit maximizing and  
 51 competitive theoretical world of perfect competition characterized  
 52 by an infinite number of producers, resources move to their most  
 53 profitable uses. In such a circumstance, an economy's potential  
 54 for economic growth is maximized since perfect markets are  
 55 acting as perfect transmission media for resources.

56 However the real world is not characterized by ubiquitous  
 57 perfect competition and the efficiency of resource allocation is  
 58 constrained by imperfections in markets. For example, monopolies,  
 59 or single suppliers of products distort competitive resource  
 60 allocation. In the continuum between monopolies (single suppliers)  
 61 and perfect competition (a "large" number of suppliers), we can  
 62 identify oligopolies, or markets which contain "few sellers"  
 63 selling differentiated, but substitutable products, and, monopolistic  
 64 competition, or markets where there are a large number of sellers  
 65 which sell products which are good substitutes and may be differentiated  
 66 in the minds of the consumers. Both oligopoly and monopolistic

1  
67 competition are examples of imperfect competition which may  
68 restrict the free flow of resources and affect the efficiency of  
69 resource allocation.

70 Production procedures in an economic system may be  
71 characterized as a process in which resources such as land,  
72 labour and capital are combined in some proportion, and given  
73 some type of technology for the purpose of producing goods or  
74 services. Economies of scale may affect a particular production  
75 process so that as a single producer produces larger quantities  
76 of the product, his per unit costs of production decrease.  
77 Economies of scale may result from specialization in the use of  
78 productive resources (assembly-line workers doing repetitive  
79 tasks more efficiently) or the spreading of fixed costs (more  
80 intensive use of fixed cost resource such as plant space).

81 A production process may also generate externalities,  
82 or external economies and diseconomies. These may be described  
83 as forces arising out of a particular production process, which  
84 do not affect its internal operations, yet produce discernable  
85 external economic effects. For example, air pollution may be  
86 caused by a particular firm or industry. This is a form of  
87 external diseconomy, the cost of which is borne by the world  
88 outside of the firm or industry. On the other hand, if a firm  
89 establishes a training program which educates workers who can  
90 then be hired by other firms, that firm is producing an external  
91 economy. The most important aspect of external diseconomies and  
92 external economies is that their cost and benefits, respectively,  
93 are external to the initiating entity and therefore they do not  
94 play a role in the resource allocation decision-making of profit  
95 maximizing enterprises. The education "industry" can be said to  
96 produce external economies through its indirect contribution to  
97 economic growth, and external diseconomies through its possible  
98 relationship with social tension and unrest.

Government has a major role in most economic systems. Economists separate the economic role of government into two components: ensuring efficient resource allocation and an equitable distribution of income in society. Government responsibility in the area of resource allocation is made necessary by the existence of externalities, which act to make private expenditure decisions less than perfect from the social point of view. An individual purchases education for the benefits which he personally expects to receive from it. If his education provides some benefit to society, over and beyond that which he personally receives, then he can hardly be expected to consider this broader, external benefit in his investment decision. Consequently, there is an argument for government subsidy of industries such as education, where substantial external economies exist, in order to ensure a sufficiently high level of investment. Concomitantly, there are economic arguments for government interference with industries where external diseconomies are being created, under the assumption that profit maximizing firms will always seek to externalize as many of their costs as possible.

Government builds its fund of spending power, and consequently, a large portion of its fund of economic power, by levying taxes on productive entities in the economic system. Taxation provides government revenue for subsidies to some sectors of the economic system, and a means of redistributing income in order to establish equity in income distribution. Taxation may be characterized as regressive if lower income-earners contribute a larger portion of their incomes than do higher income earners, progressive, if higher income-earners contribute a higher portion of their incomes, or neutral if all income-earners contribute the same proportion of their incomes.

Since government is faced with a large number of opportunities for investing in public programs, it must develop schemes for evaluating and attaching priorities to them. Analytic models which generate benefit-cost ratios, rate-of-return statistics or net present values may be utilized to evaluate public investment programs.

134           The benefit-cost ratio is a number (usually a single, whole  
135 one, like 16 or 234) used to express for a public project or  
136 system what might be called "profitability" in business or  
137 industry. Just as profit is a measure of how many dollars we  
138 get back for every dollar we spend or invest, so this ratio  
139 suggests the relationship between the costs of a project (usually  
140 in some definite time period) and the ultimate benefits or returns  
141 to the public or some sector of the public. Sometimes the numbers  
142 used to compute this ratio are reduced by a discount rate which  
143 estimates the difference between the present and future worth  
144 of something. That is, my education will be worth more to me  
145 ten years from now than it is today. Hence its present value is  
146 lower, and the discount rate suggests how much lower. When we  
147 are not sure what rate to use, as in the case of social or  
148 other intangible values, we sometimes use the rate of interest  
149 the government pays us on the bonds we buy from it.

150           The old expression "A bird in the hand is worth two in the  
151 bush" crudely expresses the idea of net present value. The  
152 net value, as we use the word in common speech, is what is left  
153 after everything we can account for has been deducted. For most  
154 things of value, different people have a different time preference.  
155 A meal I can eat right now, while I am hungry, may be worth more  
156 to me than one I can't have until tomorrow afternoon. Or, if I  
157 know the price of subway tokens will go up tomorrow, it is more  
158 worthwhile for me to buy them today than tomorrow.

159           The idea of present value is important in any analysis of  
160 economic factors but is especially tricky in the analysis of  
161 higher education. In talking about interest rates, for example,  
162 we can ask the following question: If my bank pays 6 per cent inte  
163 compounded quarterly, how much do I have to deposit right now  
164 if I want to have \$1,000, including accrued interest, ten quarters  
165 from today? The answer is the present value. In higher education,  
166 one might ask: If a doctor at age 50 earns \$40,000 a year, and if  
167 I want to become a doctor, starting at age 22, what is the present  
168 value of my income at age 50?

169       The rate of return provides a different expression of the  
170       profitability of public investment projects. This term is  
171       comparable to profitability indices used by business firms,  
172       where profits are expressed as a percentage of resource costs.

13

7. SURVEY OF LITERATURE ON COST-BENEFIT ANALYSES OF PSE

The objective of this appendix is to place the Systems Research Group study into a broad perspective based on:

- 1) The economic literature on human capital theory, and,
- 2) a number of specifically comparable studies of investment in higher education in Ontario.

This survey should provide a benchmark upon which the SRG study may be appraised, relative to other works in the field.

The literature on human capital theory and the economics of education is characterized by its breadth and diversity. For example, Mark Blaug, The Economics of Education: a Bibliography, (Oxford, Pergamon, 1966), contains a list of 2000 titles, written during the past eight years. An even more comprehensive bibliography is found in, Marine Webster, Educational Planning and Policy: an international bibliography, (Syracuse University Press, 1969); this bibliography contains 654 pages describing the literature on practical applications of the economics of education in educational planning.

In reviewing the literature it became evident that no study had taken a modelling or simulation approach to the analysis of costs and benefits in education. Most of the work in the field dealt with either the theory behind cost and benefit analysis or dealt with institutional cost data at levels of disaggregation beyond the scope of this study. The work of David Stager came closest in its scope and objectives but differed significantly insofar as it was not oriented towards a simulation model approach which allowed the specification of a large number (approximately 48) of variables on input and so test the sensitivity and hence the relative importance of various types of data.

This review or survey contains a specific and arbitrarily chosen set of items for analysis which are organized in the following manner:

- 1) A comprehensive description of seven monographs which have been chosen because of their direct relevance to the concepts and data explicated by the SRG study.
- 2) A generic comparison, in tabular format, of the seven particular studies and the SRG study. This will provide a component-by-component comparison of the pertinent features of all eight studies.
- 3) An abridged bibliography of studies in the field of the economics of education, which had either a direct or indirect impact on the SRG study.

### 7.1 Monographs

GARY S. BECKER, HUMAN CAPITAL  
(National Bureau of Economic Research,  
New York, 1964).

In this monograph, Becker makes an attempt to produce a "general theory" of investment in human capital. This is articulated in an analysis of the theoretical implications of resource allocation in on-the-job training. Assuming that both supply and demand sectors of the labour market are perfectly competitive, and that these sectors are characterized by profit-maximizing individuals and firms, Becker develops a model which determines prices (wages) for workers who are receiving either "specific" or "general" on-the-job training. The costs of on-the-job training are assumed by workers, in the form of lower wages, and firms, in the form of lower productivity during training. The relative shares of these costs between workers and firms are determined by the degree to which the results of the training may be sold on external markets. The costs of general on-the-job training, a form of human capital which may be sold on many markets external to the host firm, are completely assumed by the worker. The cost of specific

on-the-job training, a training which is only of use if the worker remains with the host firm, is completely assumed by the firm. By defining cost shares in this manner, Becker implicitly introduces the notion of human capital and the concept of return to investment in human capital. Human capital is described as learning which expands productivity and returns to investment in human capital as market-determined wage rewards.

Thus, in Becker's General Theory of investment in human capital, education is considered solely as an investment and no consideration is given to its features as a consumption good. The output of education is reflected in a stream of future earnings of graduates, the size of which is determined by the labour market under profit-maximizing conditions. The profit-maximizing rule developed by Becker in this study, is consistent with economic theories of marginal cost pricing and is specified as: a rate of return which equalizes present values of future receipts and future educational expenditures.

DAVID A. STAGER, MONETARY RETURNS TO POST-SECONDARY EDUCATION IN ONTARIO, (Ph.d. Dissertation, unpublished, Princetown University, 1968)

David Stager builds on the theoretical work of Becker and applies several measures of monetary returns to education to assess the returns to various higher education programs in Ontario.

Stager's work provides a number of unique contributions which have been invaluable to the SRG study:

- 1) It provides a comprehensive theoretical analysis of human capital theory relating to the question of the returns to education.

RETURNS TO COLLEGE GRADUATES (Stager)

	C A N A D A					G.B.		U.S.A.		
	Stager	Drummond	Podoluk	Wilkinson	Dodge	Blaug	Hansen	Miller	Schultz	Becker
Discount Rate	5	5	5	5	5	5	5	5	5	5
Net Present value private, before tax, private, after tax social	26,000 28,600		27,000 20-21, 000	12,700			23,500 16,700	31,600 22,500	8,000 10,000	
Benefit Cost Ratio private, before tax private, after tax social	4.5 3.3	2.6	4.9 3.8							
Internal Rate of Return private, before tax private, after tax social	15.4 12.5		19.7 17.5		12.2 9.2	18.0 9.0	11.6 10.1 10.2			13.8 13.5
Remark			1)		1)	2)				

All figures adjusted to 1968 dollars and discounted at 5% rate to the age 19  
All figures for males

- 1) Data not adjusted for participation rates, unearned incomes extended
- 2) Assumed that all differentials can be attributed to education

- 2) It contains a thorough discussion of the various measures of the returns to education, e.g. net present value, benefit-cost and rate of return statistics. Stager concludes that net present value is the most appropriate indicator for private decisions while the benefit-cost ratio is most suitable for decisions by the public sector. Internal rate of return statistics are not recommended because of computational difficulties and because these statistics provide the same sort of information as does the benefit-cost ratio.
- 3) The study contains a substantial discussion on factors which may influence measures of returns to education, such as, labour participation rates, sex, and the economic growth rate.
- 4) The study culminates in practical measures of the returns to education in Ontario, thereby providing useful benchmark data for the SRG study.

Stager includes the following interesting table of returns to post-secondary education.

S.J. HUNT, INCOME DETERMINANTS FOR COLLEGE GRADUATES AND THE RETURN TO EDUCATIONAL INVESTMENT, (University Microfilm Inc. Ann Arbor, Michigan, 1962)

A major portion of Hunt's study is devoted to an analysis of the determinants of income for university graduates, with special emphasis on the concept of ability and its relationship to income. The impact of all variables is measured by means of regression analysis.

Although no benefit model is specified, an attempt is made to provide some measurement of the rates of return in graduate education. Here, the methodology differs from ones used in similar studies in two ways:

- a) it measures returns which may be attributed to education alone, and
- b) it provides confidence intervals for the rates of return, which help to isolate educational effects from the others.

DAVID DODGE, RETURNS TO INVESTMENT IN  
UNIVERSITY TRAINING, THE CASE OF CANADIAN  
ACCOUNTANTS, ENGINEERS, AND SCIENTISTS.  
(Queens University)

In this paper, particular attention is devoted to distinguishing between effects of formal training and ability on earnings differentials. The author utilizes the production function approach as the analytic base for the study and begins with the assumption that the wage of an individual is a function of his training, if and only if, the marginal revenue product of his training is greater than the marginal revenue product of his ability.

Assuming that individual ability is reflected in high school attainment in mathematics, Dodge develops a model to specify the contribution of ability to the earnings of accountants, engineers and scientists. The model, which utilizes regression techniques, did show that ability (expressed as mathematics scores) does prove to be a fair predictor of success in achieving a degree, a reasonable predictor of earnings of scientists, but a very poor predictor of earnings of engineers and accountants. Dodge concludes that formal training has the greatest effect on the earnings of scientists, a lesser effect on engineers earnings and the least effect on the earnings of accountants.

OZZIE MEHMET, SECOND THOUGHT ON THE INVESTMENT  
VIEW OF HIGHER EDUCATION, (University of  
Windsor, 1970).

This paper contains two parts: the first considers the appropriateness of the investment approach to evaluating higher education, and the second is an empirical analysis of the rate of return to higher education in Ontario. The first component of the paper is of major interest, given the purposes of this review.

Mehmet's basic comment on the practicability of the investment approach to higher education is found in his quotation of Alfred Marshall's statement, "the most valuable of all capital is that

invested in human beings, [but] while human beings can be thought of a human capital in the abstract sense, it would not be proper to consider them as such in a practical sense". Mehmet suggests that the impracticability of the investment approach to higher education is shown in our inability to predict future manpower requirements for the economy. These "requirements" are volatile, unpredictable and based on a theory which overlooks imperfections in the labour market and the possibility of substitution of skilled labour.

However, while suitable as a caveat, Mehmet's criticisms of the human investment approach to higher education are not entirely valid. His discussion of manpower requirements planning underscores the inconsistencies in manpower requirements theory but fails to recognize that there is only a tenuous relationship between manpower requirements theory and the precepts of the human capital investment approach to higher education. The weaknesses in manpower requirements planning, do not negate the validity of human capital concepts and their application to higher education.

Mehmet does describe some of the weaknesses of the human capital investment approach to higher education. He indicates, quite rightly, that higher education contributes to intellectual and cultural development as well as income redistribution, and that these "results" of higher education are not explicit in most models of investment in higher education. On the other hand, these weaknesses are reflections of gaps in our knowledge of higher education, and should not be used in an argument for the irrelevance of human capital theory.

H. H. HIRSCHL, SOME ECONOMIC CONSIDERATION AND A PROCEDURE FOR A UNIVERSITY COST STUDY, (Ph.D. Dissertation, unpublished, Prodhue University, 1965)

This is a study of the nature, output, expenses and income of a university. The output of a university is defined as the intellectual growth of students and staff. Since this product can not

be quantified, costs are based on class units (meetings of students and teacher) which have been defined as proxies of output. The production function of a university is defined as a linear cost function, which relates expenses and number of classes. Other production factors (for example capital) are not taken into account. Since the derived marginal cost curve is horizontal, marginal analysis is impossible.

Hirschl's analysis utilizes an "accounting" approach and provides a good example of how to organize cost accounting and budgeting procedures. This kind of study, because of its micro-economic character, requires a substantial data base and access into all levels of institutional accounts.

D. C. MUNROE, THE COSTS OF POST-SECONDARY EDUCATION,  
(National Seminar, Department of the Secretary of  
State, Government of Canada).

This paper provides a comprehensive set of data on the development of post-secondary education during the last decade. The work is based on DBS data and most figures and statistics are Federal-Canada aggregates. Some effort is devoted to the projection of operating, capital and total university expenditures to the year 1980. Although no theoretical background is developed, some useful explanations and assumptions are discussed.

## 7.2 Comparison with the Other Similar Studies

The comparison has been arranged in a tabular format and employs five major categories of attributes.

1. General Characteristics
2. Enrolment
3. Cost Analysis
4. Income Redistributive Effects
5. Benefit Analysis

In reviewing the tables, it becomes clear that a wide diversity of approaches to the problems of costs and benefits have been employed.

The majority of studies appear to have a theoretical emphasis with the remainder having an empirical orientation. The work has generally been concentrated in the areas of

1. enrolment analysis
2. cost analysis
3. benefit analysis

Although no study is fully comparable to that done by SRG, the work of D. A. Stager is very closely related both in content and intent. Perhaps the greatest departure is in Stager's inclusion of private schools which were omitted from the SRG study.

No study reviewed uses a similar cost analysis technique, employing a trial balance concept broken out into several component sectors. Similarly, the methodological attempt to explicitly allocate opportunity costs is new (although the concepts have often been discussed). The only explicit allocation of opportunity cost in the literature was in the area of foregone earnings.

The entire section on the redistributive effects of education on income had never been dealt with except by Professor Richard Judy of SRG whose previous work was utilized, although it was done on a smaller scale with a lesser degree of detail.

A comparison of the benefit section is more difficult as most studies utilized different assumptions. No new statistics were generated but the range of variables is probably more complete than in any other single study. The flexibility of varying any of the parameters and assumptions makes the model a powerful tool to investigate the particular variables which have the most significant effects on either costs, redistributive effects or benefits.

For example, the growth variable which determines the changes in the annual earnings profile over an individuals lifetime seems of particular importance.

## COMPARISON

of similar studies on Post-Secondary Education

		Y Blank	Yes No	SRG 1	Stager 2	Becker 3	Dodge 4	Hunt 5	Hirschl 6
1.	<u>GENERAL CHARACTERISTICS</u>								
11	Theoretical Study	Y		Y	Y	Y	Y	Y	Y
12	Empirical Study	Y		Y	Y	Y	Y	Y	Y
13	Data								
1	Canada (U.S.A.)	Y		Y	Y	Y	(Y)		
2	Ontario	Y		Y	Y	Y			
3	Post-Secondary Education	Y		Y	Y	Y			
4	Universities only						Y		
5	Special Sample						Y		
6	Relevant time period	68/ 69		60/ 64					
2.	<u>ENROLMENT</u>								
11	Model							Y	Y
1	Explicit model definition	Y						Y	
2	Variables definition								
3	Projection								
12	Output					Y			
1	Canada (U.S.A.)	Y		Y	Y	Y			
2	Ontario	5		8					
3	Institution Categories (number)	119		219					
4	Institutions (number)	17		21					
5	Programs (number)								



4. INCOME REDISTRIBUTIVE EFFECTS ANALYSIS

Output

1	Federal Costs		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						
2	Provincial Costs		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						
3	Rest of the Economy Costs		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						
4	Student Costs		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						
5	Societal Costs		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						
6	Student Benefits		Y						
	Socio-Economic strata	(number)	5						
	Program	(number)	77						
	Total		Y						
	Percentage		Y						

SRG	Stager	Becker	Dodge	Hunt	Hirschl
1	2	3	4	5	6

# BENEFIT ANALYSIS

	SRG	Stager	Becker	Dodge	Hunt	Hirschl	Mehmet	Munroe
	1	2	3	4	5	6	7	8
51 Characteristics								
1 Outline of problems only				Y			Y	
2 Production function approach								
2 Lifetime earnings approach	Y	Y	Y		Y			
52 Model								
1 Explicit model definition	Y							
2 Variables definition	Y		Y	Y	Y			
Adjusted annual earnings due to PSE	Zijm		Y					
Unadjusted annual earnings	Xijm		Y					
Unadjusted annual earnings of H.S.			Y					
grad.	Xjl							
Tax	T(x)	Y						
Labour force participation rate	Lij	Y						
Mortality rate	Mij	Y						
Earning ability index	Ni(a)		Y		QY			
Non-pecuniary benefit	Ci							
Net Migration	Eij							
Annual Rate of growth in terms of								
G.N.E.	Gi		Y					
3 Regression analysis of variables				Y	Y			
53 Output								
1 <u>Male Cost-Benefit Analysis</u>	Y	Y						
Societal	Y	Y						
Student	Y	Y						
Rate of Return	Y	Y	Y					
Net Present Value	Y	Y	Y					
Benefit-Cost Ratio	Y	Y						
Cost (all year)	Y	Y						
Program (number)	77	28						
2 <u>Female Cost-Benefit Analysis</u>	Y	Y						
Societal	Y	Y						
Student	Y	Y						
Rate of Return	Y	Y						
Net Present Value	Y	Y						
Benefit-Cost Ratio	Y	Y						
Cost (all year)	Y	Y						
Program (number)	77	28						
3 <u>Rise in Mean Earnings due to years</u>								
Schooling			Y					
4 <u>Excess Earnings of University</u>								
Graduates							Y	

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## GENERAL

The following appendices contain all descriptive details referring to the models which are dealt with in the report. The structures of the appendices are therefore organized according to their variables (four character mnemonic) and subscripts (one, two or three capital letters in brackets).

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### A.1 Computer Model

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## GENERAL LIST OF VARIABLES

TABLE A-1

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
ATAN	Probability of entering Occupation L, given program I and Level M	D-2	L	77	I	77	M	4
BNCS	Benefit Cost Ratio	C-6	I	77				
BNFT	Present Value of Student Educational Benefits	D-2	I	77				
BUSI	Rest of the Economy Allocations Distribution	C-6		1	K	5		
CATE	Expenditure Category (Item)	B-3 B-5	H	37		1	S	116
COST	Present Value of Total Student Cost	D-2	I	77	J	17		
CRNM	Course Names	A-13		1				
DEGR	Estimated Cost per Program of a Degree	B-39	I	77	J	17		
DELT	Inflation Factor $1 + \delta$	D-4		1				
DIEF	Mortality Female	D-4 D-7		1	N	48		
DIEM	Mortality Male	D-4 D-5		1	N	48		
DISC	Discount Rate	D-9		1				
EARN	Annual Earnings of a Previous Male P.S. Student	D-9 D-15	I	77	N	48		
ENTR	Probability of Entering Occupation and ATAN	D-1	I	77	L	77		
EQIP	Academic Equipment Cost	B-3 B-19	I	77	J	17		

TABLE A-1 (cont'd)

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
EXIT	Net Migration	D-19		1				
FCOR	Federal Corpor. Tax Distribution	C-6		1	K	5		
FEDC	Federal Educational Cost	C-1	I	77	K	5		
FEDR	Percentage of the Federal Tax Fund Paid by Each Socio-econ Strata	C-6		1	K	5		
FEES	Academic Fees	B-39 B-40	I	77	J	17		
FELL	Proportion of Total Fellowships that Each Program Receives	B-39	I	77		1	S	116
FMWT	Formula Financing Weight D.U.A	B-42	I	77	J	17		
FPOR	Percentage of Operating Grants Paid by the Federal Government	C-7	H	37		1		
FRGO	Foregone Earnings of the Post-Secondary Students	B-3 B-21	I	77	J	17		
FSAL	Federal Sales Tax Distribution	C-6		1	K	5		
GIRL	Annual Earnings of a Previous Female P.S. Student	D-9 D-16	I	77	N	48		
GOVT	Governmental Allocations or Receipts	B-1	H	37	U	2		
GRDS	Graduate Students Socio-Economic Distribution	C-6		1	K	5		
GROW	Annual Rate of Growth of Productivity in Terms of GNE per Capita	D-19	R	1				

TABLE A-1 (cont'd)

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
GSAL	Graduate Students Loan Expenditures Distribution	C-6	I	77	K	5		
GSAP	Graduate Students Grants Distribution	C-6	I	77	K	5		
HSAB	Earning Ability Index of High School Graduates	D-3 D-20		1				
HSCS	Non-Pecuniary Rate of Return of High School Graduates	D-23		1				
HSEF	Annual Earnings of a Previous High School Female Graduate	D-24		1	N	48		
HSEM	Annual Earnings of a Previous High School Male Graduate	D-24		1	N	48		
HSPF	Labour Force High School Female Graduate Participation Rate	D-24		1	N	48		
HSPM	Labour Force High School Male Graduate Participation Rate	D-24		1	N	48		
INDX	Superfix c-o refers to the elapsed period, c-year of the analysis, o-year of data publication	D-28		1				
INST	Institutional Allocations or Receipts	B-1	H		U	2		
INT	Internal Rate of Return	D-4	I	77				
LABF	Labour Force P.S. Female Student Participation Rate	D-24		1	N	48		
LABR	Labour Force P.S. Male Student Participation Rate	D-24		1	N	48		
LOAN	Proportion of Total Loan Expenditures Reimbursed in Favour of each Program	B-44	I	77		1		

TABLE A-1 (cont'd)

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
MUNC	Provincial Property Tax Distribution	C-6		1	K	5		
NPV	Net Present Value	D-2	I	77				
OSAL	U.G. Students O.S.A.P. Loan Expenditures Distribution	C-6	I	77	K	5		
OSAP	U.G. Students O.S.A.P. Grants Distribution	C-6	I	77	K	5		
PARA	Percentage of P.S. Students Earnings Attributable to their Ability	A-12		1				
PASS	Transition Rate between Ac. Years	B-44	I	77	J	17	S	116
PCOR	Provincial Corpor. Tax Distribution	C-6		1	K	5		
PPOR	Percentage of Operating Grants Paid by the Provincial Government	C-7	H	37		1		
PRIV	U.G. Students Socio-Economic Distribution	C-6	I	77	K	5		
PROC	Provincial Educational Cost	C-2	I	77	K	5		
PROG	Program Enrolment	B-3 B-26	I	77	J	17	S	116
PROV	The Percentage of the Provincial Tax Fund Paid by each Income Group	C-6		1	K	5		
PSAL	Provincial Sales Tax Distribution	C-6		1	K	5		
PSEC	Earning Ability Index of a P.S. Student	D-3		1				

TABLE A-1 (cont'd)

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
RATE	Rate Applied to CATES	B-3 B-29	H	37		1	S	116
RECO	Rest of Economy Educational Cost	C-3	I	77	K	5		
REST	Rest of the Economy Allocations or Receipts	B-1	H	37	U	2		
RETN	Rate of Return	D-2	I	77		1		
SNOB	Non-Pecuniary Rate of Return of P.S. Students	D-23		1				
SOCC	Societal Educational Cost	C-4	I	77	K	5		
SOCI	Society Allocations or Receipts	B-1	H	37	U	2		
STBE	Student Educational Benefits	C-4	I	77	K	5		
STCO	Student Educational Cost	C-3	I	77	K	5		
STUD	Student Allocations or Receipts	B-1	H	37	U	2		
TAXS	Income Tax Rate	D-25	P					
TEMP	Temporary Cost Matrix-Allocation of CATES into Program I and Year J	B-37	H	37	I	77	J	17

TABLE A-1 (cont'd)

ARRAY			SUBSCRIPT					
NAME	DESCRIPTION	PAGE	1-row		2-column		3	
			NAME	SIZE	NAME	SIZE	NAME	SIZE
1	2	3	4	5	6	7	8	9
TECC	Total Cost of the Rest of Economy	B-3	I	77	J	17		
TGOC	Total Government Cost	B-2	I	77	J	17		
TIME	Percentage of Foregone Earnings regarding the Attendance of P.S.E.	B-3 B-35		1				
TINC	Total Institution Cost per Program and Academic Year	B-2	I	77	J	17		
TSOC	Total Societal Cost per Program and Academic Year	B-3	I	77	J	17		
TSTC	Total Student Cost per Program and Academic Year	B-2	I	77	J	17		
YEAR	Average Institution Cost per Student, Program and Ac. Year	B-38	I	77	J	17		
YEAS	Average Societal Cost per Student, Program and Ac. Year	B-38	I	77	J	17		

## AUXILIARY VARIABLES

TABLE A-1a

CLIN	Institutional Classroom Cost per year.	B-51	I	4	J	6		
CLSO	Societal Classroom Cost per yr	B-52	I	4	J	6		
CONC	Classroom Contact Hours	B-52	I	4	J	6		
CONH	Hospital Contact Hours	B-52	I	4	J	6		
HOIN	Institutional Hospital Cost Per Year	B-51	I	4	J	6		
HOSO	Societal Hospital Cost per Yr.	B-52	I	4	J	6		
TCNC	Total Contact Classroom Hours	B-51	I	4	J	6		
TCNH	Total Contact Hospital Hours	B-51	I	4	J	6		
TDEG	Total Degree Cost	B-52	I	4	J	6		
TSTH	Total Cost per Student, Year	B-52	I	4	J	6		
TSOH	Societal Total Cost per Student, Year	B-52	I	4	J	6		
TTIN	Institutional Total Cost per y	B-52	I	4	J	6		
TTSO	Societal Cost per Year	B-52	I	4	J	6		
YECR	Classroom Cost per Student, yr	B-51	I	4	J	6		
YECS	Societal Classroom Cost P.S/yr	B-52	I	4	J	6		
YEHR	Hospital Cost per Student/year	B-51	I	4	J	6		
YEHS	Societal Hospital Cost P.S/Y	B-52	I	4	J	6		

GENERAL LIST OF SUBSCRIPTS

TABLE A-2

S U B S C R I P T			TABLE
NAME	DESCRIPTION	SIZE	
1	2	3	4
H	Expenditure Category	37	A-6
I	Program	77	A-4
J	Academic Year (or Degree )	17	A-5
K	Socio-Economic Strata	5	A-8
L	Occupation	77	-
M	Level of Education	4	A-9
N	Age	48	A-10
P	Earnings (the argument of the tax function)		-
R	Calendar Year		-
S	Institution	116	A-3
T	Institution Category	6	-
U	Trial Balance Account Side	2	A-7

## GENERAL LIST OF INSTITUTIONS

TABLE A-3

Computer Subscript	Institution Name	Documentation Code
	<u>UNIVERSITIES</u>	
01	Brock	U01
11	Carleton	U02
21	Guelph	U03
31	Lakehead	U04
41	Laurentian	U05
42	Main Campus (University College included)	U051
43	Huntington University	U052
44	Thorneloe University	U053
45	University of Sudbury	U054
46	Algoma College	U055
47	College de Hearst	U056
48	Nipissing College	U057
51	McMaster	U06
61	Ottawa	U07
62	St. Augustine's College	
71	Queen's	U08
81	Toronto	U09
	St. George Campus	U091
82	St. Michael's College	U096
83	Trinity College	U095
84	Victoria University	U094
85	Erindale College	U093
86	Scarborough College	U092
91	Trent	U10
101	Waterloo	U11
	Main Campus	U111
102	St. Jerome's College	U112
103	Renison College	U113
104	St. Paul's College	U114
105	Conrad Grebel College	U115
111	Waterloo-Lutheran	U12
121	Western	U13
	Main Campus	U131
122	Brescia College	U132
123	Huron College	U133
124	King's College	U134
131	Windsor	U14
141	York	U15
851	Ontario Institute for Studies in Education	U20

TABLE A-3 (cont'd)

Computer Subscript	Institution Name	Documentation Code
	<u>COLLEGES OF APPLIED ARTS &amp; TECHNOLOGY</u>	
201	Algonquin	C01
211	Cambrian	C02
221	Centennial	C03
231	Conestoga	C04
241	Confederation	C05
251	Durham	C06
261	Fanshawe	C07
271	George Brown	C08
281	Georgian	C09
291	Humber	C10
301	Lambton	C11
311	Loyalist	C12
321	Mohawk	C13
331	Niagara	C14
341	Northern	C15
351	Seneca	C16
361	Sheridan	C17
371	Sir S. Fleming	C18
381	St. Clair	C19
391	St. Lawrence	C20
401	Ryerson	C21
	<u>TEACHERS COLLEGES</u>	
601	Hamilton	T03
602	Lakehead	T04
603	Lakeshore	T05
604	London	T06
605	North Bay	T07
606	Ottawa	T08
607	Peterborough	T09
608	St. Catherines	T10
609	Stratford	T11
610	Sudbury	T12
611	Toronto	T13
612	University of Ottawa	T14
613	Windsor	T15
651	Ontario College of Education - U. of T.	U16
652	Althouse College of Education - Western	U17
653	McArthur College of Education - Queen's	U18

TABLE A-3 (cont.)

Computer Subscript	Institution Name	Documentation Code
	<u>NURSING SCHOOLS</u>	
701	Barrie	N01
702	Belleville	N02
703	Brantford	N03
704	Brockville	N04
705	Chatham General	N05
706	Chatham St. Joseph's	N06
707	Cornwall	N07
708	Galt	N08
709	Guelph General	N09
710	Guelph St. Joseph's	N10
711	Hamilton Chedoke General	N11
712	Hamilton Civic	N12
713	Hamilton St. Joseph's	N13
714	Kingston General	N14
715	Kingston Hotel Dieu	N15
716	Kirkland	N16
717	Kitchener St. Mary's	N17
718	Kitchener - Waterloo	N18
719	London St. Joseph's	N19
720	London Victoria	N20
722	Niagara Falls	N22
723	North Bay	N23
724	Orillia	N24
725	Oshawa	N25
726	Ottawa Civic	N26
727	Ottawa General	N27
728	Ottawa Monfort	N28
729	Owen Sound	N29
730	Pembroke	N30
731	Peterborough Civic	N31
732	Peterborough St. Joseph's	N32
734	Sault Ste. Marie General	N34
735	Sault Ste. Marie Plummer Memorial	N35
736	St. Catherine	N36
737	St. Thomas Elgin	N37
738	Stratford	N38
739	Sudbury	N39
740	Thunder Bay McKeller	
741	Thunder Bay General Port Arthur	N41
742	Thunder Bay St. Joseph's	N42
743	Timmins	N43
744	Toronto Branson	N44
745	Toronto General	N45
747	Toronto Mt. Sinai	N47
748	Toronto North York	N48
749	Toronto Queensway	N49
751	Toronto Sick Children's	N51
752	Toronto St. Michael's	N52

TABLE A-3 (cont'd)

Computer Subscript	Institution Name	Documentation Code
753 754 755 756 757 758 759 760	Toronto St. Joseph's Toronto Wellesley Toronto Western Toronto Women's College Windsor Hotel Dieu Windsor Metropolitan Windsor Salvation Army Woodstock	N53 N54 N55 N56 N57 N58 N59 N60
	<u>AGRICULTURE COLLEGES</u>	
801 802 803 804	Centralia - Huron Park Kemptville New Liskeard Ridgetown	M11 M12 M13 M14
	<u>MISCELLANEOUS EDUCATION</u>	
811 841	Police College Ontario College of Art	M21 U19

TABLE A-4

<u>University - Undergraduate</u>		UA-3 Code
01	Agriculture	01
02	Architecture	02
03	Commerce	05
04	Dentistry	06
05	Engineering	07
06	Fine & Applied Arts	08
07	Forestry	09
08	Household & Food Sciences	10
09	Hygiene & Public Health	11
10	Journalism	12
11	Law	13
12	Library Science	14
13	Premedicine-Medicine	15,16
14	Music	17
15	Nursing	18
16	Pharmacy	19
17	Physical & Health Education	20
18	Physical & Occupational Therapy	21
19	Social Work	25
20	Veterinary Medicine	26
21	Theology	29
22	General Arts - 1st Year Honour Arts	03

TABLE A-4 (cont'd)

23	Upper Years Honour Arts	04
24	General Science - 1st Year Honour Science	23
25	Upper Years Honour Science	24
26	Secretarial Science	22
27	Hospital Administration	
28	Landscape Architecture	27
29	Public Administration	28

University - Graduate

01	Agriculture	41
02	Architecture	42
03	Commerce	44
04	Dentistry	45
05	Engineering	46
06	Fine & Applied Arts	47
07	Forestry	48
08	Household & Food Science	51
09	Hygiene & Public Health	53
10	Journalism	54
11	Law	55
12	Library Science	56
13	Medicine	58
14	Music	59

TABLE A-4 (cont'd)

15	Nursing	60
16	Pharmacy	61
17	Physical & Health Education	62
18	Physical & Occupational Therapy	64
19	Social Work	67
20	Veterinary Medicine	69
21	Theology	72
22	Geography	49
23	Humanities	52
24	Physical & Biological Sciences	63
25	Mathematics	57
26	Child Study	43
27	Hospital Administration	50
28	Psychology	65
29	Public Administration	66
30	Residual Social Sciences	68
65	O.I.S.E. Programs	

University - Diploma

30	Public Administration	
31	General Arts	03
32	Commerce	05
33	Music	17
34	Nursing	18

TABLE A-4 (cont'd)

35	Physical & Occupational Therapy	21
36	General Science	23
37	Nursing Technology	27
38	Dental Hygiene	30
39	Public Health Nursing	31
40	Technology Courses	32
41	Preliminary Year	33
42	Medical Interns & Residence	34

Colleges of Applied Arts & Technology

43	Business	- Three Year
		- Two Year
44		- Two Year
45		- One Year
46	Applied Arts	- Three Year
47		- Two Year
48		- One Year
49	Technological	- Three Year
50		- Two Year
51		- One Year
52	Apprentice Training	
53	Other & Extension	
54	Manpower Retraining	
74	Ryerson Programs - Business	
75		- Technical

TABLE A-4 (cont'd)

76	Ryerson Programs - Arts
77	- Health
<u>Teachers Colleges</u>	
	Courses lead to an Interim Elementary School Teacher's Certificate:
55	One-year Course
56	Two-year Course
57	Course for University Graduates (One Year)
58	Primary Specialist Certificate Course
	Special Courses :
	(Additional program beside 55-58)
59	French
60	Music
61	Home Economics
<u>Nursing Schools</u>	
62	Two Year
63	Two Year plus one
64	Three Year
<u>Miscellaneous Education</u>	
66	Police College Programs

TABLE A-4 (Cont'd)

Agriculture Colleges

70	Agriculture
71	Home Economics
72	Animal Health Technology
73	Three Month Dairy Course

J ACADEMIC YEAR (OR DEGREE)

TABLE A-5

01	<u>Undergraduate</u>	-	First Year
02		-	Second
03		-	Third
04		-	Fourth
05		-	Fifth
06		-	Sixth or make-up
07		-	First Year Master's Program
08		-	Part-time - Program Registration
09		-	Part-time - Course Registration
	<u>Graduate</u>		
10	M.Phil & Diploma Programs		
11	Master's & 1st Stage Doctoral		
12	Master's	-	Part-time - Program Registration
13	Master's	-	Part-time - Course Registration
14	Thesis		
15	Doctoral	-	2nd Stage
16	Doctoral	-	Part-time - Program Registration
17	Doctoral	-	Part-time - Course Registration

H

EXPENDITURE CATEGORIES

TABLE A-6

1	Government Operating Grants
2	Gifts for Operating Purposes
3	Student Fees
4	Student Academic Equipment
5	Ontario Student Aid Program Grants
6	Ontario Student Aid Program Loans Expenditures
7	Ontario Graduate Fellowships
8	Gifts for Student Financial Aid
9	Institutional Student Awards
10	Direct Student Awards
11	Institutional Net Expenditures
12	Government Capital Grants
13	O.U.C.A.C. Financing
14	Mortgage Financing
15	Other Financing
16	Campaign and Capital Gifts
17	Depreciation
18	Repayments to O.U.C.A.C.
19	Other Repayments
20	N/A
21	Government Refund of Sales Tax
22	Government Operating Grants
23	Government Capital Grants
24	Gifts
25	Loss of Tax from Gifts
26	Ontario Student Aid Program Grants & Fellowships
27	Ontario Student Aid Program Loans Expenditures
28	Direct Student Awards
29	Loss of Tax from Direct Awards
30	Student Fees
31	Student Academic Equipment
32	Loss of Tax on Student Expenditures
33	Foregone Student Annual Earnings
34	Loss of Tax on Student Foregone Earnings
35	Institutional Employed Capital
36	Loss of Corporation Tax
37	Loss of Property Tax

U

TRIAL BALANCE ACCOUNTS SIDES

TABLE A-7

1	Allocation of Resources	-	Debit
2	Receipts of Resources	-	Credit

K      SOCIO-ECONOMIC STRATA

TABLE A-8

<u>Student's Parent's Annual Income:</u>			
1	Under	-	\$2,999
2	\$ 3,000	-	\$4,999
3	\$ 5,000	-	\$6,999
4	\$ 7,000	-	\$9,999
5	\$10,000		and up

M      LEVEL OF EDUCATION

TABLE A-9

1	Students graduating from high school but not attending an institution of P.S.E.
2	Students attending an institution of P.S.E. but not graduating
3	Students successfully completing a program of P.S.E., but not continuing for further qualification from an institution of P.S.E.
4	Students successfully completing the first stage of P.S.E., and going on to the next stage of P.S.E.

N      AGE

TABLE A-10

1	17 Years	13	29 Years	25	41 Years	37	53 Years
2	18	14	30	26	42	38	54
3	19	15	31	27	43	39	55
4	20	16	32	28	44	40	56
5	21	17	33	29	45	41	57
6	22	18	34	30	46	42	58
7	23	19	35	31	47	43	59
8	24	20	36	32	48	44	60
9	25	21	37	33	49	45	61
10	26	22	38	34	50	46	62
11	27	23	39	35	51	47	63
12	28	24	40	36	52	48	64

## A.1 Computer Model

### A.1.1 Technical Aspects

The current computer model is composed of six major modules, supported by eleven additional routines. Each major module contains the logic to perform a specific given function; for example, the input module reads the input stream, checks for errors and establishes all necessary data elements. The six major modules and their supporting routines are as follows:

<u>Module</u>	<u>Supporting Routines</u>
1. Main Control	1. Bad Data Routine
2. Input	None
3. Trial Balance Generator	1. Report Printer 2. Opportunity Cost Generator 3. Translator for Trial Balance
4. Cost Generator	1. Undergraduate Costs Adder 2. Report Printer
5. Redistributive Calculator	1. Report Printer
6. Benefits Calculator	1. Curve Fit Routine 2. Taxation Routine 3. Rate of Return Routine 4. Earnings Calculator

All of the report printing routines control the actual reporting phases of their respective modules.

The program has been written in FORTRAM IV, and is designed to run on any IBM 360 series computer that possesses a minimum 300,000 bytes of storage, and operates under OS/360. In order to minimize execution time, the program (comprising approximately 1800 source statements) uses the FORTRAM H compiler with the maximum optimization option.

At this time the program is stored on magnetic disk or tape with the data being read in via a card deck.

The data consists of two major components, the common data base and the institution specific data. The model also possesses the ability to perform aggregate

analyses on common institutions; for example, all universities. At this time the common data base represents approximately 6,000 variables with an institution specific data base ranging from 100 - 2000 variables depending on the institute in question.

Since there are approximately  $35 \times 10^6$  arithmetical operations required for the analysis of one institution, the model requires a large, high speed computer. Even so, the model is limited by the internal speed of the machine. At this writing the model has been successfully run on a UNIVAC 1108 and an IBM 360/65. Average execution times range from 15 - 30 seconds per institution with an average around 20 seconds. Thus in order to run the 120 institutes for Ontario a computer run of approximately 40 minutes of CPU (Central Processing Unit) time is required. The costs of such a run will vary but are in the \$400 - \$600 range.

#### A.1.2 Experimental Capabilities of the Model

Each institute has associated with it 48 variables which are uniquely defined. These variables are available for experimentation at any time by manipulating the input data. In addition, variables may be multiples defined in any one computer run, allowing the user an excellent opportunity to study and evaluate the effects of different financing and policy decisions.

The user may specify any undergraduate course as a pre-requisite for a graduate course - automatically including all undergraduate costs in the graduate program. Similarly any of the input variables may be user defined at any time. Section 5.3 outlines all input variables to the model. (These may be re-defined by the user).

FIGURE A-11

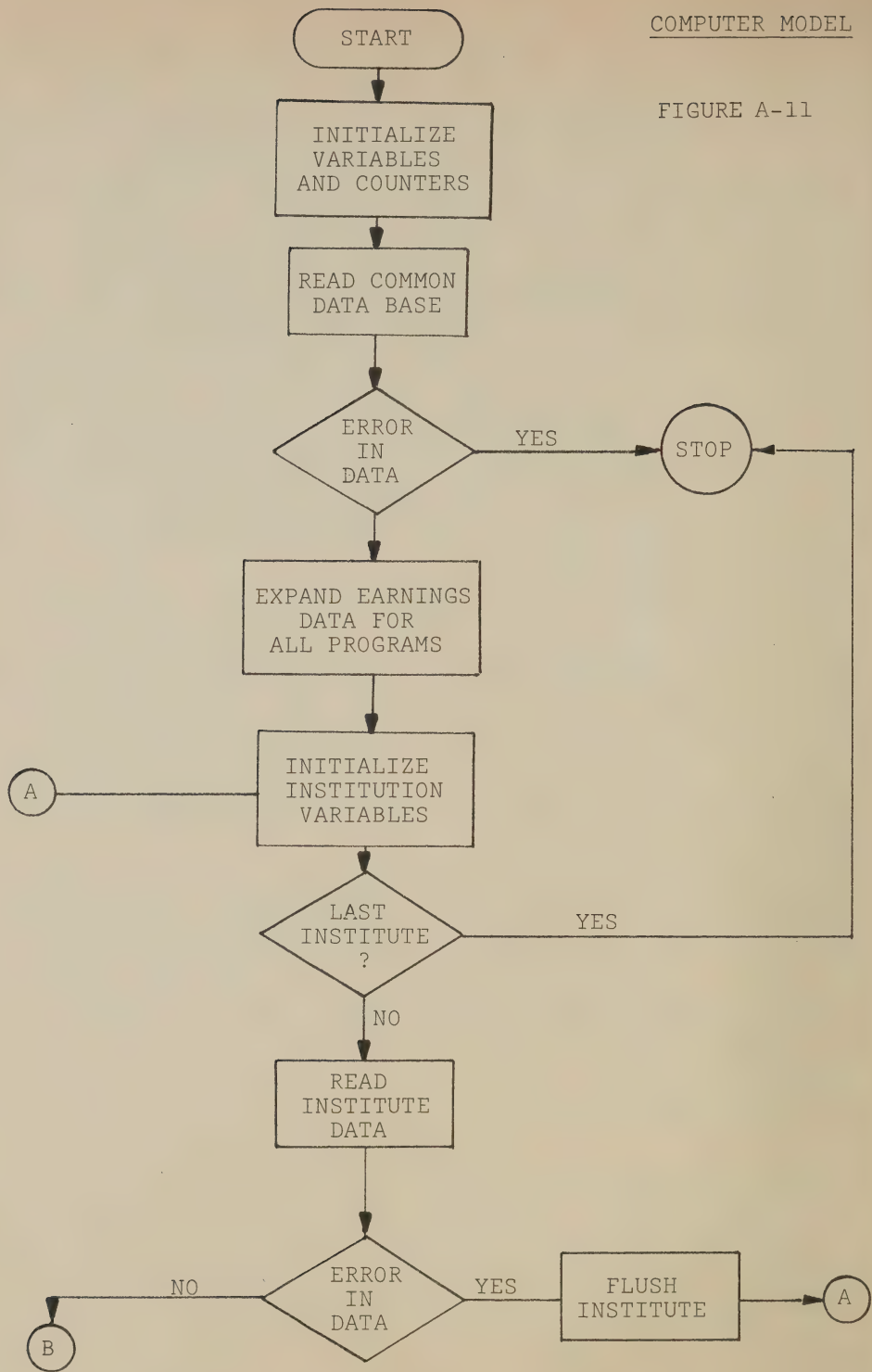


FIGURE A-11 (Cont'd)

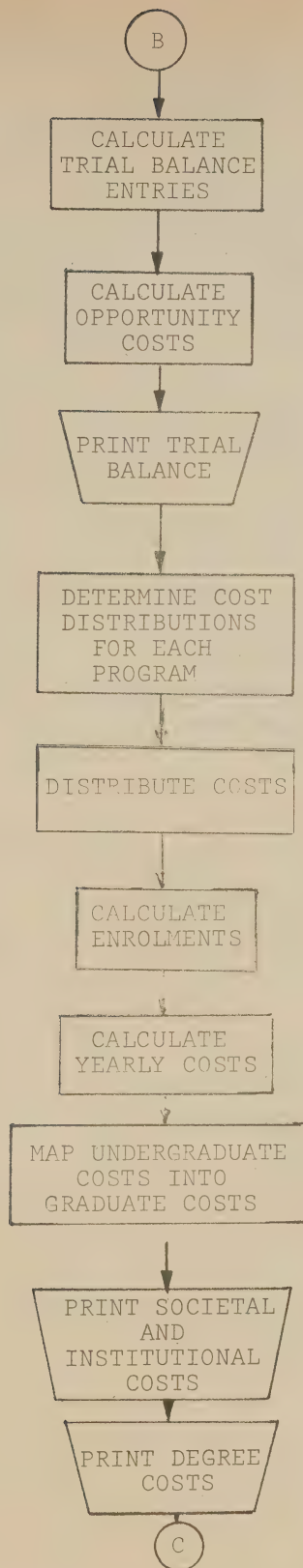
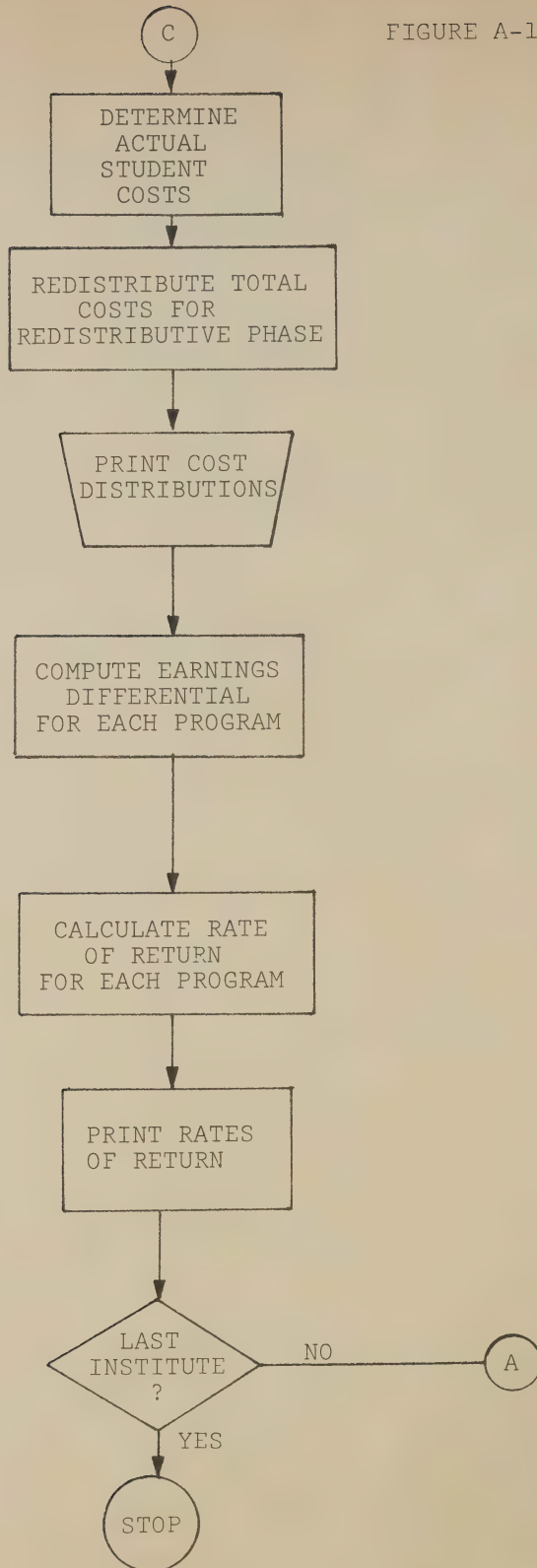


FIGURE A-11 (Cont'd)



### A.1.3 Input Variables

The input variables have been divided into nine groups in order to facilitate the input structure. The routine INPUT will read any of the input variables, test for errors and print errors that occur in the input deck.

Table A-12

ARRAY NAME	DESCRIPTION	COMMAND	KARIND	ARRAY SIZE
XTBAL(1,I,J)	Program Enrolment	PROG	1	77 x 17
XTBAL(2,I,J)	Equipment Costs	EQIP	2	77 x 17
XTBAL(3,I,J)	Foregone Earnings	FRGO	3	77 x 17
XTBAL(4,I,J)	Time Weight	TIME	4	77 x 17
XTBAL(5,I,J)	Academic Fees	FEES	5	77 x 17
XTBAL(6,I,J)	Formula Weight	FMWT	6	77 x 17
XTBAL(7,I,J)	Graduate Distribution	GRDS	7	77 x 17
XTBAL(8,I,J)	Transition Rate	PASS	8	77 x 17
XTBAL(9,I,J)	Undergraduate Dist'n	PRIV	9	77 x 17
DISTM(1,I)	Business Distribution	BUSI	10	1 x 5
DISTM(2,I)	Federal Corp. Dist'n	FCOR	11	1 x 5
DISTM(3,I)	Federal Distribution	FEDR	12	1 x 5
DISTM(4,I)	Federal Sales Dist'n	FSAL	13	1 x 5
DISTM(5,I)	Municipal	MUNC	14	1 x 5
DISTM(6,I)	Provincial Corp. Dist'n	PCOR	15	1 x 5
DISTM(7,I)	Provincial Distribution	PROV	16	1 x 5
DISTM(8,I)	Provincial Sales Dist'n	PSAL	17	1 x 5
XCBAL(1,I)	Category	CATE	18	1 x 37
XCBAL(2,I)	Rate	RATE	19	1 x 37
GRAD(1,I,J)	Graduate Loans	GSAL	20	77 x 5
GRAD(2,I,J)	Graduate Grants	GSAP	21	77 x 5
GRAD(3,I,J)	Undergraduate Loans	OSAL	22	77 x 5
GRAD(4,I,J)	Undergraduate Grants	OSAP	23	77 x 5
XMONEY(1,I)	Probability M/K	ATAN	24	1 x 77
XMONEY(2,I)	Fellowship Distribution	FELL	25	1 x 77
XMONEY(3,I)	Loans Distribution	LOAN	26	1 x 77
XMONEY(4,I)	P-S Ability	PSEC	27	1 x 77
XMONEY(5,I)	Non-pecuniary Earning	SNOB	28	1 x 77
ENTR(I,J)	Probability I/MK	ENTR	29	77 x 77
XMORT(1,I)	Male Mortality	DIEM	30	1 x 48
XMORT(2,I)	Female Mortality	DIEF	31	1 x 48
XMORT(3,I)	Male H.S. Earnings	HSEM	32	1 x 48
XMORT(4,I)	Female H.S. Earnings	HSEF	33	1 x 48
XMORT(5,I)	Male Part	HSPM	34	1 x 48
XMORT(6,I)	Female Part	HSPF	35	1 x 48
XEARN(1,I,J)	Male Earnings	EARN	36	77 x 48
XEARN(2,I,J)	Female Earnings	GIRL	37	77 x 48
EXIT	Migration	EXIT	38	1
XGROW(I)	Growth Rate	GROW	39	48
XLABR(1,I,J)	Male Participation	LABR	40	2 x 48
XLABR(2,I,J)	Female Participation	LABF	41	2 x 48

TABLE A-12 (cont'd)

ARRAY NAME	DESCRIPTION	COMMAND	KARIND	ARRAY SIZE
CONST(1)	Data Consist	DELT	42	1
CONST(2)	H-S Ability	HSAB	43	1
CONST(3)	H-S Non-pecuniary	HSCS	44	1
CONST(4)	Index	INDX	45	1
CONST(5)	Parameter	PARA	46	1
CONST(6)	Discount Rate	DISC	47	1
CRNM(I,J)	Program Name (prog,yr)	CRNM	48	77 x 6
UCIN(I,J,K)	Mass Undergrad. Costs to	UCIN	50	2 x 10x1
INST	Institute Header Grad. Costs.	INST	49	10
End of data for each institute		LAST	50	
End of all processing		FINI		

## APPENDIX B

### COST ANALYSIS MODEL

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B. COST ANALYSIS MODEL

B.1 Trial Balance

The Trial Balance presents the allocation of funds between the INSTITUTION (or Institution category), the SOCIETY and its SECTORS, and between the SECTORS themselves. The double-entry bookkeeping method has been applied so that each transaction involves a two-way and hence self-balancing entry and two-way self-balancing posting.

B.1.1 Definitions

Entries:

If  $H = 1, 12, 13, 21, 36, 37$   
 $CATE(H) * RATE(H) = INST(H,2) \& GOVT(H,1) \& SOCI(H,1)$

If  $H = 2, 8, 14, 15, 16$   
 $CATE(H) * RATE(H) = INST(H,2) \& REST(H,1) \& SOCI(H,1)$

If  $H=3$   
 $CATE(H) * RATE(H) = INST(H,2) \& STUD(H,1) \& SOCI(H,1)$

If  $H=4, 30, 31, 33$   
 $CATE(H) * RATE(H) = STUD(H,1) \& SOCI(H,1)$

If  $H=5, 6, 7$   
 $CATE(H) * RATE(H) = STUD(H,2) \& GOVT(H,1)$

If  $H=9$   
 $CATE(H) * RATE(H) = INST(H,1) \& STUD(H,2)$

If  $H=10$   
 $CATE(H) * RATE(H) = REST(H,1) \& STUD(H,2)$

If  $H=11, 17, 35$   
 $CATE(H) * RATE(H) = INST(H,1)$

If  $H=18$   
 $CATE(H) * RATE(H) = INST(H,1) \& GOVT(H,2) \& SOCI(H,2)$

If  $H=19$   
 $CATE(H) * RATE(H) = INST(H,1) \& REST(H,2) \& SOCI(H,2)$

If  $H=22, 23, 26, 27$   
 $CATE(H) * RATE(H) = GOVT(H,1) \& SOCI(H,1)$

If  $H=24, 28$   
 $CATE(H) * RATE(H) = REST(H,1) \& SOCI(H,1)$

If  $H=25, 29$   
 $CATE(H) * RATE(H) = GOVT(H,1) \& REST(H,2)$

If  $H=32, 34$   
 $CATE(H) * RATE(H) = GOVT(H,1) \& STUD(H,2)$

The intermediate results:

INST(H,1)	institutional allocations
INST(H,2)	institutional receipts
STUD(H,1)	student allocations
STUD(H,2)	student receipts
GOVT(H,1)	government allocations
GOVT(H,2)	government receipts
REST(H,1)	rest of the economy allocations
REST(H,2)	rest of the economy receipts
SOCI(H,1)	societal allocations
SOCI(H,2)	societal receipts
CATE(H)	see B.1.2. Input Variables
RATE(H)	see B.1.2. Input Variables

Output:

$\sum_{IJ} \text{TINC}(I,J) - \text{TOTAL INSTITUTIONAL COST}$

is the sum of all institutional allocations minus institutional receipts in terms of opportunity cost. In other words it is the TOTAL of all allocations minus the subtotal of receipts in terms of opportunity costs.

$$\sum_{IJ} \text{TINC}(I,J) = \sum_{H=1}^{37} \text{INST}(H,1) - \sum_{H=22}^{37} \text{INST}(H,2)$$

$\sum_{IJ} \text{TSTC}(I,J) - \text{TOTAL STUDENT COST}$

is the sum of all student allocations minus all student receipts, or simply the final BALANCE

$$\sum_{IJ} \text{TSTC}(I,J) = \sum_H^{37} \text{STUD}(H,1) - \sum_H^{27} \text{STUD}(H,2)$$

$\sum_{IJ} \text{TGOC}(I,J) - \text{TOTAL GOVERNMENT COSTS}$

is the sum of all governmental allocations minus all governmental receipts (final balance)

$$\sum_{IJ} \text{TGOC}(I,J) = \sum_H^{27} \text{GOVT}(H,1) - \sum_H^{37} \text{GOVT}(H,2)$$

$\sum_{IJ} \text{TECC (I,J)} - \text{TOTAL COST OF THE REST OF THE ECONOMY}$

is the sum of all allocations of this sector minus all receipts (final balance)

$$\sum_{IJ} \text{TECC (I,J)} = \sum_H^{37} \text{REST(H,1)} - \sum_H^{37} \text{REST (H,2)}$$

$\sum_{IJ} \text{TSOC (I,J)} - \text{TOTAL SOCIETAL COST}$

is the sum of all societal allocations minus all societal receipts. Also the sum of TSTC(s), TGO C(s) and TECC(s), (final balance), given the institution(s)

$$\sum_{IJ} \text{TSOC (I,J)} = \sum_H^{37} \text{SOCI(H,1)} - \sum_H^{37} \text{SOCI(H,2)}$$

$$\sum_{IJ} \text{TSOC (I,J)} = \text{TSOC(s)}$$

$$\text{TSOC(s)} = \text{TSTC(s)} + \text{TGO C(s)} + \text{TECC(s)}$$

### B.1.2 Input Variables

CATE (H) - EXPENDITURE CATEGORY

This vector accepts all of the expenditures associated with any institution or institutional category. The dollar value is capable of accepting variants from 0 - 9 x 10<sup>9</sup> dollars. See

EQIP (I,J) - ACADEMIC EQUIPMENT COST

This matrix lists equipment expenditures for all institutions, by program (I) and academic year (J). The expenditures range from \$25 to \$348.

FRGO (I,J) - FOREGONE STUDENT ANNUAL EARNINGS

This is the matrix listing the foregone annual earnings of the student due to his or her attendance of PSE by program (I) and acad.year (J).

PROG (I,J) - PROGRAM ENROLMENT

This is the matrix containing the physical (unadjusted) enrolments for the particular program (I) and acad. year or level (J), given the institution.

## RATE (H) - RATE APPLIED TO EXPENDITURE

This vector accepts rates which are to be applied to the CATES. Rate values vary from 0-1.000, with a default to 1.000 for the ordinary expenditure categories. If a fraction of the expenditures were to be excluded, then  $\text{RATE (H)} < 1.000$ .

## TIME (1) - PERCENTAGE OF FOREGONE EARNINGS

This is the constant set at .8 due to the assumption that annually every student spends in average 80% of time otherwise necessary for a regular employment.

TRIAL BALANCE CATEGORIES

TABLE B-1

CATE (H)

OUT-OF-POCKET COSTS

1. Government Operating Gr.
2. Gifts for Oper. Purp.
3. Student Fees
4. Student Ac. Equipment
5. OSAP Grants
6. OSAP Loans Expenditures
7. Ont. Grad. Fellowships
8. Gifts for St. Fin. Aid.
9. Inst. Student Awards
10. Direct Student Awards
11. Instit. Net Expendit's
12. Govern't Capit. Grants
13. OUCAC Financing
14. Mortgage Financing
15. Other Financing
16. Campaign & Capit. Gifts
17. Depreciation
18. Repayment to OUCAC
19. Other Repayment
20. N/A
21. Refund of Sales Tax

Subtotals --

Surplus (Deficit) Appl.

BALANCE --

OPPORTUNITY COSTS

22. Government Operat. Gr.
23. Govern't Capit. Grants
24. Gifts (All)
25. Loss of Tax (Gifts)
26. OSAP Grants & Fello's
27. OSAP Loans Expendit's
28. Direct Stud. Awards
29. Loss of Tax (Awards)
30. Student Fees
31. Student Ac. Equipment
32. Loss of Tax (F+E)
33. Student Ann'l Earn's
34. Loss of Tax (Earn's)
35. Inst. Employed Capit.
36. Loss of Corpor. Tax
37. Loss of Property Tax

Subtotals --

Surplus (Deficit) Appl.

BALANCE

TOTALS

BALANCE

## CATE (1) GOVERNMENT OPERATING GRANTS

Sources: primary source: F-1, F-2  
intermediate form: F-70-3

Allocation: GOVERNMENT, SOCIETY

Receipt: INSTITUTION

These grants represent the prevalent (or the only - in some cases) funds for the financing of current operations of the institution. They are provided by the government offices, namely, by the Department of University Affairs, Ontario Department of Education, Department of Health or Department of Justice on the basis of actual enrolment or on basic income units

## CATE (2) GIFTS FOR OPERATING PURPOSES

Sources: primary source: F-1, F-2  
intermediate form: F-70-4

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt: INSTITUTION

Gifts come from individual donors or corporations, etc., with or without restrictions regarding their use. These gifts are solely for operating purposes.

## CATE (3) STUDENT FEES

Source: primary source: F-1, F-2  
intermediate form: F-70-2

Allocation: STUDENTS, SOCIETY

Receipt: INSTITUTION

Embrace: Academic Fees (tuition, library, laboratory,  
physical education)  
Student Government (organizations, clubs)  
Additional (admission, late registration, etc.)

All of these fees are obligatory and they are therefore the relevant part of the student's cost; similarly, (partly) they cover the relevant operating expenditures of the institution. They do not include Student Service (Residence, Health, etc.), because these costs are not necessarily associated with the education only.

B-  
CATE (4) STUDENT ACADEMIC EQUIPMENT

Sources:        ΣΣ EQUIP (I,J) \* PROG (I,J) I J

Allocation:    STUDENTS, SOCIETY

Receipt:        -

This, the second cost to the students, covers books and similar expenses, which are stated as "other academic expenses" in the Post-Secondary Student Population Survey 1968-1969 published by DBS. (F-29 & F-1) The transaction associated with this cost is an internal one which does not require a double-entry in the Trial Balance, but assumes a set of transfers between imaginary students accounts. See EQUIP (I,J) below.

CATE (5) O.S.A.P. GRANTS

Sources:    primary source:        F-7 (15C)  
             intermediate form:    F-72-15/7

Allocation:    GOVERNMENT

Receipt:        STUDENTS

This transaction is the re-allocation or transfer of government funds to students. It does not represent a societal cost because the DECREASE of government funds is offset by a corresponding INCREASE of student funds.

CATE (6) O.S.A.P. LOANS EXPENDITURES

Sources:    primary source:        F-7 (15C)  
             intermediate form:    F-72-16/7

Allocation:    GOVERNMENT

Receipt:        STUDENTS

According to current practice, the loans to students provided by the chartered banks and guaranteed by the Federal Government, are part of the integrated provincial and federal student award program (Canada Student Loans Plan) under the name of O.S.A.P. The participation of the Federal Government decreases the risk borne by the chartered banks and accordingly holds the going rate of interest low ( $5 \frac{3}{4}\%$ ). Beyond this, the loans are interest free until six months after graduation, but in the meantime the interest charged by banks is paid by the Federal Government. This provision actually decreases the total cost of the students loans and creates indirect receipt to students equal to the annual interest payment at the fixed rate, computed from the new balance of all loans provided to students during the school year 1968-19

## CATE (7) ONTARIO GRADUATE FELLOWSHIPS

Sources: primary source: F-7 (16A)  
intermediate form: F-72-17/7

Allocation: GOVERNMENT

Receipt: STUDENTS

This is also the re-allocation of government funds as described above.

## CATE (8) GIFTS FOR STUDENT FINANCIAL AID

Sources: primary source: F-1, F-2  
intermediate form: F-70-7

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt: INSTITUTION

Gifts for student financial aid are an example of restricted funds. They are provided by individual donors, corporations, etc., and are recorded separately in the institutional income statements.

## CATE (9) INSTITUTIONAL STUDENT AWARDS

Sources: primary source: F-1, F-2  
intermediate form: F-70-28

Allocation: INSTITUTION

Receipt: STUDENTS, SOCIETY

Student Awards shorten the student and the society cost and are a relevant part of the institutional operating expenditures. They involve EXTERNAL transactions because this money represents an income to the students and therefore to society, as a whole. Institutional awards are financed from the gifts [CATE (8) ] and/or from other institutional funds.

## CATE (10) DIRECT STUDENT AWARDS

Sources: primary source: F-31  
intermediate form: F-72-18

Allocation: REST OF THE ECONOMY

Receipt: STUDENTS

These awards are paid to students directly by the

individual donors or by different private, public, government or foreign agencies, usually, but not necessarily, on the basis of a separate application. A typical example is the Ontario Scholarship (for students completing grade XIII, with an average of 80% or better). These awards are actually only a re-distribution of student costs between the other sectors of the economy and do not affect the societal budget.

#### CATE (11) INSTITUTIONAL NET EXPENDITURES

Sources: primary source: F-1, F-2  
intermediate form: F-70-38

Allocation: INSTITUTION

Receipt: -

The total amount of the institutional expenditures contains only the items relevant to the educational programs of the institution. Therefore, the following exclusions have been made:

- \*33 - Research (sponsored and assisted). The income for sponsored research was assumed to cover the relevant expenditures. The possible difference between such income and its associated expenditures is viewed as research directly associated with the educational programs and therefore considered a relevant cost.
- 34 - Student Financial Aid. Exclusion is made because the same amount enters to the Trial Balance as CATE (9)
- 35 - Student Service Receipts. It is assumed that student services operate on a non-profit basis, therefore, the receipts cover a part of probable expenditures which can be considered as not directly associated with educational programs, e.g. dining rooms, residence etc. On the other hand Student Services also provide other services (non-paid) e.g. information, placement etc., therefore the residue or the difference between incomes and expenditures is relevant to the institutional expenditures.
- 36 - Net deficit on ancillary enterprises. Some institutions do not distinguish ancillary enterprises from student services while others do. However, the deficit or surplus should not increase or decrease the total expenditures.

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\* These figures refer to the lines of form F-70.

In accordance with the usual institutional practice, the statements of current expenditures do not include charges for the depreciation of capital assets. This is the internal transaction.

#### CATE (12) GOVERNMENT CAPITAL GRANTS

Sources: primary source: F-5  
intermediate form: F-72-19/7

Allocation: GOVERNMENT, SOCIETY

Receipt: INSTITUTION

Major capital financing is made available through the Ontario Universities Capital Aid Corporation. It was incorporated for the purpose of purchasing DEBENTURES from institutions which have been issued for capital projects that have been approved by the Minister of University Affairs. The combined principal and interest payments due on the debentures are provided through the Province of Ontario Capital Grant. Such grants are stated in the DBS-CAUBO Report but it is necessary to add, that these figures do not agree either with the DUA's accounting nor with the Minister's Report (F-7). This is because the institutional fiscal year is not in coincidence with the governmental fiscal year (ending March 31st).

#### CATE (13) O.U.C.A.C. FINANCING

Sources: primary source: F-5  
intermediate form: F-72-20/7

Allocation: GOVERNMENT, SOCIETY

Receipt: INSTITUTION

As mentioned above, this is the major source of financing of approved capital projects realized by the eligible institutions. Each institution is required to provide through its own resources the balance between the project cost and the approved government's share and this is done

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through selling debentures to O.U.C.A.C. The institution then makes a monthly request for the funds required to meet this share on the basis of construction progress. Inconsistencies between the DBS-CAUBO figures and the Minister's Report also exist because of the shift in fiscal years. Since the outstanding balance of this capital aid is tied up in the institutional capital assets, (which are certainly necessary for the educational process) it is considered as an allocation of funds relevant to the current period of time.

#### CATE (14) MORTGAGE FINANCING

Sources: primary source: F-5  
intermediate form: F-72-21/7

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt: INSTITUTION

This kind of capital financing is provided by C.M.H.C. and/or by the other financial institutions. It serves as a supplement to the financing through O.U.C.A.C. because of the inelegibility of some projects (residences etc.), for this type of financing. As far as the C.M.H.C. is concerned, it considers itself as a non-governmental agency and is put into the REST OF THE ECONOMY account.

#### CATE (15) OTHER FINANCING

Sources: primary sources: F-5  
intermediate form: F-72-22/7

Allocation: REST OF THE ECONOMY, SOCIETY

Receipts: INSTITUTION

This financing is analogous to mortgages CATE (14). The difference consists only in the legal terms of transactions.

#### CATE (16) CAMPAIGN & CAPITAL GIFTS

Sources: primary source: F-5  
intermediate form: F-72-23/7

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt: INSTITUTION

These transactions are intended for special projects or gifts of capital assets (land, buildings, libraries etc.) and made without charge. Donors can be private persons, corporations, etc.

## CATE (17) DEPRECIATION

Source: primary source: F-1, F-2  
intermediate form: F-72-30/7

Allocation: INSTITUTION

Receipt: -

This is an INTERNAL transaction of the institution. The amount is the lump sum of the book values of buildings, equipment and constructions in progress and creates a basis for depreciation charges.

Depreciation is a process of allocation and represents the transformation of fixed assets into cash. In other words, it distributes the cost of fixed assets over their estimated useful life. For our purposes, the buildings are assumed to have a 40 year life, equipment and a 5 year life.

## CATE (18) REPAYMENTS TO O.U.C.A.C.

Source: primary source: F-5  
intermediate form: F-72-27/7

Allocation: INSTITUTION

Receipt: GOVERNMENT, SOCIETY

This is the EXTERNAL transaction and it works as a partial offset of the receipt described in paragraph CATE (12)

## CATE (19) OTHER REPAYMENTS

Source: primary source: F-5  
intermediate form: F-72-28/7

Allocation: INSTITUTION

Receipt: REST OF THE ECONOMY, SOCIETY

See CATE (18)

CATE (21) GOVERNMENT REFUND OF THE SALES TAX

Sources: CATE (17)

Allocation: GOVERNMENT

Receipt: INSTITUTION

It is provided by the government at the rate of 4% from the total construction and replacement costs, which equals the CATE (17)

SUBTOTALS 1

These are actual expenditures which have already been paid or received by each sector of the economy and by the institution.

SURPLUS (DEFICIT) APPLICATION TO INST. FUNDS

Source: SUBTOTALS 1

Allocation: SURPLUS (INSTITUTION)

Receipt: DEFICIT (INSTITUTION)

This is an INTERNAL transaction of the institution. A DEFICIT means that the difference between receipts and allocations was financed from other institutional funds, i.e. from existing assets and other current income (miscellaneous, receipts from service to outside interest on capital funds, sales of capital assets etc.) A SURPLUS contributes to these funds. Particular notice should be given to the interpretation of this deficit or surplus. We emphasize that these are NET RESULTS associated with the EDUCATIONAL PROCESS. This means that a deficit can be compensated by other incomes (specified above) which are considered as a result of business activities of the institution, but not necessarily part of the educational programs.

BALANCE 1

Shows how much the educational programs provided by the institution, institution category or by the Ontario Post Secondary Education System cost, how much has been paid by societal funds and the extent of participation by the economy sectors on these costs.

CATE (22) GOVERNMENT OPERATING GRANTS

Sources: CATE (1)

Allocation: GOVERNMENT, SOCIETY

Receipt: -

This cost is created by the application of capital to educational operations. This is an INTERNAL transaction of the government. The opportunity cost is computed similarly to the foregone earnings under the assumption that the capital could have been applied to the purchase of Canada Savings Bonds.

CATE (23) GOVERNMENT CAPITAL GRANTS

Sources: CATE (12) + CATE (13) - CATE (18)

Allocation: GOVERNMENT, SOCIETY

Receipt: -

See CATE (22)

CATE (24) GIFTS

Sources: CATE (2) + CATE (8) + CATE (16)

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt:

This cost is induced by the decision to subsidize the educational institution. This is an INTERNAL transaction of the REST OF THE ECONOMY. A comparable alternative use of the capital is the purchase of Canada Savings Bonds.

CATE (25) LOSS OF TAX FROM THE GIFTS

Sources: CATE (24)

Allocation: GOVERNMENT.

Receipt: REST OF THE ECONOMY

This transaction re-distributes the taxable part of possible earnings between the Rest-of-the-Economy and the government. The re-distribution reduces the foregone earnings of the Rest-of-the-Economy Sector.

CATE (26) O.S.A.P. GRANTS & FELLOWSHIPS

Sources: CATE (5) + CATE (7)

Allocation: GOVERNMENT, SOCIETY

Receipt: -

See CATE (22)

CATE (27) O.S.A.P. LOANS EXPENDITURES

Sources: CATE (6)

Allocation: GOVERNMENT, SOCIETY

Receipt: -

See CATE (22). The relevant part for computation of the opportunity cost is the total of the annual interest payments on behalf of students.

CATE (28) DIRECT STUDENT AWARDS

Sources: CATE (10)

Allocation: REST OF THE ECONOMY, SOCIETY

Receipt: -

See CATE (24)

CATE (29) LOSS OF TAX FROM THE DIRECT AWARDS

Source: CATE (28)

Allocation: GOVERNMENT

Receipt: REST OF THE ECONOMY

See CATE (25)

CATE (30) STUDENT FEES

Source: CATE (3)

Allocation: STUDENT, SOCIETY

Receipt: -

This cost is created by the decision to enrol in an institution of Higher Education. This is an INTERNAL transaction of the STUDENTS. An alternative use of these funds is the purchase of Canada Savings Bonds.

CATE (31) STUDENT ACADEMIC EQUIPMENT

Source: CATE (4)

Allocation: STUDENTS, SOCIETY

Receipt: -

See CATE (30).

## CATE (32) LOSS OF TAX ON STUDENT EXPENDITURES

Source: CATE (30) + CATE (31)Allocation: GOVERNMENTReceipt: STUDENTS

This transaction re-distributes the student's opportunity cost through possible taxation.

## CATE (33) FOREGONE STUDENT ANNUAL EARNINGS

Source:  $\Sigma \text{ FRGO (I,J) * PROG(I,J) * TIME (I,J)}$   
IJAllocation: STUDENTS, SOCIETYReceipt: -

See FRGO (I,J) below.

## CATE (34) LOSS OF TAX ON STUDENT FOREGONE EARNINGS

Source: CATE (33)Allocation: GOVERNMENTReceipt: STUDENTS

See CATE (32)

## CATE (35) INSTITUTIONAL EMPLOYED CAPITAL

Source: primary source: F-1, F-2  
intermediate form: F-72-14/7Allocation: INSTITUTIONReceipt: -

This is an INTERNAL transaction of the institution.

## CATE (36) LOSS OF CORPORATION TAX

Source: CATE (35)Allocation: GOVERNMENT, SOCIETYReceipt: INSTITUTION

This transaction re-distributes the taxable part of the foregone earnings CATE (35) with regard to

the capital employment in the educational institution.

CATE (37) LOSS OF PROPERTY TAX

Source: primary source: F-1, F-2  
intermediate form: F-72-31/7

Allocation: GOVERNMENT, SOCIETY

Receipt: INSTITUTION

See CATE (36). This foregone tax is computed from the book value of the land and buildings employed by the institution.

SUBTOTALS 2

Show the opportunity costs due to the educational expenditures in terms of out-of-pocket costs above, on the allocation sides of all accounts and simultaneous the re-distribution of these opportunity costs among the participating sectors.

SURPLUS (DEFICIT) APPLICATION TO INST.FUNDS

Source: SUBTOTALS 2

Allocation: SURPLUS -(INSTITUTION)

Receipt: DEFICIT -(INSTITUTION)

This is an INTERNAL transaction of the institution. See SURPLUS (DEFICIT) following CATE (21).

BALANCE 2

Shows the additional cost incurred by the expenditures and capital stock in connection with educational programs, as well as the participation of the sectors of the economy in these costs.

TOTALS

These are summations of all receipts, allocations and surplus (deficit) applications.

BALANCE 3

Provides the final results, the TOTAL COST of education paid and foregone (in rejecting other investment alternatives) by society and the major sectors of the economy.

## EQIP (I,J)

This cost component includes the academic expenses beyond fees that the individual Post-Secondary Student incurs. These include such items as expenditures on books, materials, personal equipment and instruments, as well as conventional transportation home and back at Christmas and mid-term. Not included are items such as entertainment expenses, food and beverage expenditure, and living expenses because these are incurred by everyone independent of having student status.

It should be noted that the figures from the best source of 1968-1969 data for Ontario (F-29) are suspects in their accuracy. Consider three subjects, - Engineering Law, and Arts. The value of all three is within \$3, yet it is known that either an engineering or law student may take more courses with more expensive texts than an arts student, so that these figures may be questioned.

This might be corrected by doing some original data research to produce reliable results. The present situation yields a satisfactory indication of the order of magnitude of the miscellaneous academic expenses incurred by a representative Post-Secondary Student. The data is given by program (I) and academic year (J). See TABLE B-2.

Notes:

- (1) Programs 15, 34, 62, 63, 64 (Nursing), Acad. Year 1, 2, ..., 8 - the values were taken from Horizon (F-10)
- (2) All other programs - from Lucow Study (F-29) - median
- (3) All graduate programs, Ac. Year 10, 11, 12, 15, 16 - from Lucow study (F-29).
- (4) The transportation allowance \$73 (F-39) was added to all full-time programs, Ac. Years 1, 2, 3, 4, 5, 6, 7, 10, 11, 15.
- (5) Assumed, Part-time students live in the neighbourhood of institutions.



EQIP (I,J)

TABLE B-2 (Cont'd)

I	J	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
48	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	231	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	224	224	224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	231	-	-	-	-	-	-	-	231	-	-	-	-	-	-	-	-	-
54	224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	230	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	230	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	230	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	230	-	-	-	-	-	-	-	-
62	348	348	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	348	348	348	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	348	348	348	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	230	-	-	228	239	155	-	-	248	175	-
66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	230	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	230	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	230	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
74	231	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	231	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	231	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	231	231	231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Sources: F-29 Post-Secondary Population Survey, 1968, W.H. Lucow, Table 6 - Other Academic Equipment, DBS, 1970 (Unpublished)
- F-10 Horizons, A guide to educational opportunities in Ontario for 1970-71 beyond the secondary school level, Ontario Department of University Affairs, (p.9 - Books and Student Supplies for Nursing Schools), Toronto 1970.
- F-39 Stager, D.A.; Monetary Returns to Post-Secondary Education in Ontario, (Graduate Studies Supplement), 1970.

FRGO (I,J)

The student, by his attendance in a post-secondary institution foregoes earnings. That is, if a student spends 30 weeks at school when he might otherwise be working, he is giving up 30 weeks of income.

The approach taken here is that all opportunity costs are relative to the earnings of the high school graduate who chose not to enter into Post-Secondary Education. For the graduate student, this perhaps is unrealistic. His control group might well be argued to be the cohort of employees with whom he shared his undergraduate training. As this phase of the study was limited to  $m=3$ , there is no problem. It is strongly advocated, however, that this approach should be the operational one when a more complete set of data is used.

The basic information about the high school graduate earnings (Canada, 1967) was obtained from the Consumer Finance Branch of DBS by consultation (TABLE B-3).

#### HIGH SCHOOL GRADUATE EARNINGS (ANNUALLY)

TABLE B-3

Age	1967 - Canada			1968
	Males	Females	Average	Ontario
1	2	3	4	5
15-19	1,657	1,419	1,538	1,692
20-24	4,040	2,875	3,457.5	3,803
25-34	6,357	3,158	4,757.5	5,233
35-44	7,488	3,239	5,363.5	5,900
45-54	7,538	3,303	5,420.5	5,963
55-64	7,130	3,544	5,332	5,871

Source (col.1-3): Consumer Finance Branch,DBS.

First of all, there were two adjustments necessary:

- (1) Conversion of 1967 data into 1968
- (2) Conversion of Canada data into Ontario

This has been done by means of the composite industrial index (Canada) 68/67

$$I_{68/67}^c = \frac{\bar{W}_{68}^c}{\bar{W}_{67}^c}$$

which was multiplied by the inter-regional index Ontario/Canada, 1968

$$I_{o/c}^{68} = \frac{\bar{W}_{68}^o}{\bar{W}_{68}^c}$$

where  $\bar{W}_{68}^c$  stands for an average weekly wage (industrial composite) Canada, 1968.

$\bar{W}^c$  Canada, 1967

$\bar{W}_{68}^o$  Ontario, 1968

so that we have obtained the composite inflator for Ontario, 1968.

$$i_{68/67} = \frac{\bar{W}_{68}^o}{\bar{W}_{67}^c} = \frac{113.52}{102.83} = 1.1$$

AVERAGE WEEKLY WAGES

TABLE B-4

Year	Ontario	Canada
	$\bar{W}^o$	$\bar{W}^c$
1961	81.30	78.24
1962	83.65	80.54
1963	86.22	83.27
1964	89.82	86.51
1965	94.41	91.01
1966	99.40	96.34
1967	105.86	102.83
1968	113.52	109.88

Source: F-19 Review of Employment and average weekly wages and salaries, Cat.No.72-201 (Annual), Volumes 1957-67 & 1966-68, Table 6, industrial composites, DBS, 1969.

In order to generate table B-5 it was necessary to do the linear interpolation between the values 1,692 and 3,803 (Table B-3, Col.5), and make certain assumptions. Particularly, for the following programs (I) and academic years (J):

FRGO I = 1, 2, ..., 77

J = 1, 2

the interpolated values have been used.

FRGO I = 1,2,4,5,7,10,11,12,13,15,16,18,19,20,21,43,46,  
49,52,53,63,64,65,74,75,76,77

J = 3,4,5,6

the interpolated values have been used

J = 7,8

it was assumed, that salaries and wages within the corresponding ages (22,23,24) are roughly the same (\$3,803)

FRGO I = 3,6,8,9,14,17,22,23,24,25,26,27,28,29

J = 6,7,8

it was assumed, that students attending those programs would earn in average \$8,578, because of the demand for labour situation in the corresponding occupations

FRGO I = 1,2,3,...,29,65

J = 10,11,12,14,15,16

As the foregone earnings of graduate students were used the starting salaries of university graduates, average of males and females.

See EARN (I,N) and GIRL (I,N).

0 (I,J)

## FOREGONE STUDENT ANNUAL EARNINGS

TABLE B-5

J	1	2	3	4	5	6	7	8	10	11	12	14	15	16
1692	2114	2536	2598	3380	3803	3803	3803	5926	5926	5926	5926	5926	5926	5926
1692	2114	2536	2598	3380	3803	3803	3803	5926	5926	5926	7306	7306	7306	7306
1692	2114	2536	2598	3380	8579	8579	8579	8579	8579	8579	8579	8579	8579	8579
1692	2114	2536	2598	3380	3803	3803	3803	9270	9270	9270	9270	9270	9270	9270
1692	2114	2536	2598	3380	3803	3803	3803	7306	7306	7306	7306	7306	7306	7306
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	3803	3803	3803	7099	7099	7099	7099	7099	7099	7099
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	3803	3803	3803	4632	4632	4632	4632	4632	4632	4632
1692	2114	2536	2598	3380	3803	3803	3803	4879	4879	4879	4879	4879	4879	4879
1692	2114	2536	2598	3380	3803	3803	3803	5568	5568	5568	5568	5568	5568	5568
1692	2114	2536	2598	3380	3803	3803	3803	3803	3803	3803	13646	13646	13646	13646
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	3803	3803	3803	4731	4731	4731	4731	4731	4731	4731
1692	2114	2536	2598	3380	3803	3803	3803	6262	6262	6262	6262	6262	6262	6262
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	3803	3803	3803	4505	4505	4505	4505	4505	4505	4505
1692	2114	2536	2598	3380	3803	3803	3803	6674	6674	6674	6674	6674	6674	6674
1692	2114	2536	2598	3380	3803	3803	3803	3803	3803	3803	10641	10641	10641	10641
1692	2114	2536	2598	3380	3803	3803	3803	3803	3803	3803	4450	4450	4450	4450
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	2114	2536	2598	3380	8578	8578	8578	8578	8578	8578	8578	8578	8578	8578
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-	-
1692	2114	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-	-
1692	2114	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-	-

(Cont'd)

<div><div>J</div><div>I</div></div>	1	2	3	4	5	6	7	8	10	11	12	14	15	16
50	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
51	1692	-	-	-	-	-	-	-	-	-	-	-	-	-
52	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
53	1692	-	-	-	-	-	-	3903	-	-	-	-	-	-
54	1692	-	-	-	-	-	-	-	-	-	-	-	-	-
55	1692	-	-	-	-	-	-	-	-	-	-	-	-	-
56	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
57	1692	-	-	-	-	-	-	-	-	-	-	-	-	-
58	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
63	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
64	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	3803	3803	-	5926	5926	5926	5926	5926
66	1692	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
71	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
72	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
73	1692	2114	-	-	-	-	-	-	-	-	-	-	-	-
74	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
75	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
76	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-
77	1692	2114	2536	-	-	-	-	-	-	-	-	-	-	-

SOURCES:     Tables B-3, B-4

# PROG (I,J)

Student enrolments for the many Ontario Post-Secondary Institutions provide basic data input for this study. For each institution, this information is provided by reading values into a matrix named PRØG. Its rows (I) represent the various programs available at the Post-Secondary level. The columns (J) differentiate levels i.e. academic years and types of instruction for each program. Accordingly, the level of detail of enrolment input is by program (I) and academic year (J).

The structure of PRØG is shown by the TABLES A-4 and A-5 (p. A-13 and A-18)

NOTE: PRØG is partitioned into an undergraduate and a graduate compartment. For the first twenty-one programs, the course represented across a row is the same for both levels, i.e. I=05 gives undergraduate Engineering and/or graduate Engineering. For the next 9 programs, no such exact match-up is possible. With I=22 to I=25, it can probably be said that the graduate programs are each a subset of the more general preceding undergraduate study, but not how large a one.

For example, I-23, represents Honours Arts for the undergraduate level. Humanities at the graduate level is represented by the remaining row entries. Undoubtedly the composition of this course is mainly from Honours Arts. But further, this undergraduate program generates the greatest part of Psychology, Geography, Public Administration, and Residual Social Sciences graduate level courses. (This inability to clearly identify uniquely these graduate disciplines with undergraduate ones, means the usual across-the-row implied flow cannot be maintained for this sector of 9 rows.)

It is not obvious why one would require a separate row for the nursing courses, - that offered by universities, that offered by the CAAT's, and that offered by nursing schools, - when it has been said that the enrolments are entered in this matrix for each institution. Clearly, if there were one record allowed for any one course-type, regardless of what type of Post-Secondary Institution was giving it, this would do because the institution would be known by its number.

However, for each enrolment by program and level, there correspond certain other cost items given by program and level, - student fees, formula weights, academic expenses, pass-fail rates. In phase 1, these are invariable with respect to institution. On the other hand, they do vary with respect to similar training from the different institution types. To facilitate an easy correspondence between PRØG (I,J) and, say, FEES (I,J) for this first version of the model, PRØG was expanded as shown so I & J would be identical in all cases. An obvious consequence

of this structure is that for all these further items' matrices, there should be an entry in it at every cell corresponding to cells in PRØG containing an enrolment figure.

Greater efficiency in the model structure could be achieved by overlaying for a later phase of this project. The bounded area in the preceding diagram showing the organization of PRØG is a presently unutilized portion of the file. Tightly structured, PRØG probably need no longer than 23 x 17 for the present post-secondary situation. Besides using much less core storage much improved computational efficiency would result from this change. This would naturally require more sophisticated programming.

### Notes

These concern how many of the final figures for the enrolment input were calculated.

For the universities, our data source was DUA's UA-3 forms.<sup>F-3</sup> A two-term scholastic year was assumed because it is currently most prevalent. Other institutional arrangements require conversion to this standard base.

Some institutions presently operate on a trimester system. Their enrolments were converted to determine an 8-month standard enrolment by the following formula:  $1/2$  (fall-term + winter-term + spring-term) enrolments. Guelph and Waterloo are two universities using such a three-term system as is Ryerson, among the CAAT's. For the other universities, normally a December enrolment figure for the entire year was taken.

Police College offers various courses of different duration. Assuming a 32-week teaching year, the number of student-year equivalents was calculated for the instruction received at that institution, and entered as its enrolment.

The undergraduate enrolments at the universities are given for each year for full-time students. At the graduate level, levels only can be distinguished. These levels do not necessarily correspond to any fixed period of successful study. A Master's candidate may retain such status from 8 months to a possible 5 years. Some assumption of a median or mean value must be made concerning occupation time in a graduate level.

Since the various graduate levels are not structured to coincide with study periods, the approach to this area may be more likely to change for further phases.

Enrolments haven't been received for either Forest Technical School or Fire College. O.C.A. offers a number of courses.

Regarding each of the Ryerson courses, enrolments have been distributed among 3 years assuming a 10% differential among enrolments in each course as one progresses through it.

For the 3-month Dairy Short course offered at certain Agricultural Colleges, its enrolment was converted to an 8-month standard year equivalent by taking on-third the enrolment.

A final warning is in order. Because the study year of Nursing Schools does not span the 1968-1969 fiscal year, the nursing enrolments are unreliable to the following extent. Only 1968 calendar year enrolments were given to us. The financial expenditures corresponding to each institution relate to a 1968-1969 fiscal year. So the identification of educational expenditure with the enrolment loads cannot be ascribed with too much certainty. The project results must be scrutinized accordingly to determine what allowances should be made for this.

As far as the full-time equivalent is concerned, the following principles (F-7) for part-time students have been adopted:

- J = 8 Part-time undergraduate students (including extramural students) working towards a Baccalaureate degree - be taken on a full-course registration basis divided by six and the full-time equivalent counted in the appropriate undergraduate category.
- J = 13 Part-time graduate students (doing course work) 816 - to be taken on a full-course registration basis divided by five and the full-time equivalent counted in the appropriate graduate category-
- J = 14 Part-time graduate students (actively doing dissertation under continuing supervision) - be assigned a weight of one.

The appropriate weights (.166 for J = 8; .2 for J = 13,16) were applied internally in the programming. See TABLE B-9 (p.B-48)

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F-7 Report of the Minister of University Affairs of Ontario 1967-1968, (p. 102) Ontario Department of University Affairs Toronto, 1968.

## RATE (H) values:

RATE (1)	- Government Operating Grant	1.000
RATE (2)	- Gifts for Operating Purposes	1.000
RATE (3)	- Student Fees	1.000
RATE (4)	- Student Academic Equipment	1.000
RATE (5)	- O.S.A.P. Grants	1.000
RATE (6)	- O.S.A.P. Loans Expenditures Interest paid by the government (on behalf of students) was 6.5%. This figure was taken from the actual rate charged in 1968 to the students.	0.065
RATE (7)	- Ontario Graduate Fellowship	1.000
RATE (8)	- Gifts for Student Financial Aid	1.000
RATE (9)	- Institution Student Awards	1.000
RATE (10)	- Direct Student Awards	1.000
RATE (11)	- Institutional Net Expenditures	1.000
RATE (12)	- Government Capital Grants	1.000
RATE (13)	- O.U.C.A.C. Financing	1.000
RATE (14)	- Mortgage Financing	1.000
RATE (15)	- Other Financing	1.000
RATE (16)	- Campaign and Capital Gifts	1.000
RATE (17)	- Depreciation The depreciation rate has been set at <u>5.7%</u> on the basis of buildings and equipment portions of the total book value of capital assets of universities and CAAT's, in order to have one rate only applicable to CATE (17)	0.057
RATE (18)	- Repayment to O.U.C.A.C.	1.000
RATE (19)	- Other Repayment	1.000
RATE (21)	- Refund of Sales Tax The rate of <u>4%</u> was obtained in one of the financial statements	0.040

RATE (22)	- Government Operating Grants	0.070
RATE (23)	- Government Capital Grants	0.070
RATE (24)	- Gifts	0.070
RATE (25)	- Loss of Tax on Gifts For illustrative purposes, a rate of <u>10%</u> was utilized. This rate seems somewhat low as most people giving gifts to the institution would probably be post-secondary graduates or in a fairly affluent tax bracket. If one made the assumption that people in income brackets between \$5K and \$15K were making contributions, then the tax rates would more realistically be about 9.7% to 15.5%. The average tax rate for people earning \$25,000 and over is 30.15% and the overall average for Canada is 12.1% (all figures are taxes on gross earnings after deductions have been considered). So a realistic range would be 10% to 30% with a default to 12%.	0.100
RATE (26)	- O.S.A.P. Grants & Fellowships	0.070
RATE (27)	- O.S.A.P. Loans Expenditures	0.070
RATE (28)	- Direct Student Awards	0.070
RATE (29)	- Loss of Tax on Awards	0.100
RATE (30)	- Student Fees	0.070
RATE (31)	- Student Academic Equipment	0.070
RATE (32)	- Loss of Tax on Student Expenditures Reasoning see RATE (34)	0.100
RATE (33)	- Foregone Student Annual Earnings	1.000
RATE (34)	- Loss of Tax on Student Foregone Earnings. If one makes the assumption that students would earn between \$1,692 and \$13,645 as indicated by the foregone earnings (FRGO(I,J)) the applicable tax rates would be between 2.3% and 15.1%. Our example of <u>10%</u> is within the range but is probably somewhat high as it assumes that the average post-secondary	0.100

student would earn about \$5,000

RATE (35)	-	Institutional Employed Capital	0.070
RATE (36)	-	Loss of Corporation Tax A rate of <u>50%</u> was assumed as the standard corporation tax. The range would probably be between 28% and 52%	0.500
RATE (37)	-	Loss of Property Tax A <u>2%</u> rate has been utilized in this instance but this cannot be considered as other than a guess on our part.	0.020

The rates set at 1.000 indicate that the entire amount of the CATE (H) is to be transferred into the Trial Balance.

#### Opportunity Rates

A "social rate of discount" has been applied to the following opportunity costs: Government Operating Grant, Government Capital Grant, OSAP Grant and Fellowships, OSAP Loans Expenses, Institutional Employed Capital. The rate used is 7%. The reason this rate has been used is that it approximated the government bond rate in 1968. The government bond rate did in fact win out over any other choice of rate, as it was decided that any ideal alternative would have been practically unquantifiable. The reasoning for this conclusion is as follows:

One way of defining the cost of capital for a firm in private industry is "that minimum rate of return which any investment project must earn in order to be allocated the funds it requires". Although this always seems an odd way to conceptualize something which is a cost, it should be clear from such a definition that we are not talking about an out-of-pocket cost, rather the next best use of committed funds. This minimum required return is, of course, at least equal to the out-of-pocket cost or market price paid for those funds when raised.

On the other hand, it is imperative that one think of the cost of capital as an opportunity cost -- whether it be for the private firm or for the public agency. In the case of the corporation, the opportunity rate that should be sought, is the one that leaves the stock holders at least as well off as they would have been with their funds in a best outside use. Accordingly,

the public agency should consider the alternate rates of return that could be realized in the various sectors from which they exact their tax or borrowed dollars.

The cost of capital to a government should be used in the same way and for the same reasons as the corporate manager employs it to evaluate proposed investment. Moreover, determining the required rate of return on the government project is no less difficult than figuring out the firm's capital cost. The problems involved are considerably different, however.

The subject of cost of capital is perhaps the most overworked problem in corporate finance. It is difficult to find a known author who has not written up his discourse on the concept. Clearly, it is an important problem however, and it begs solution. The difference between an accurate and a slightly inaccurate estimate of the cost of capital if used to discount, can commit an entire investment program to disaster.

It seems strange, therefore, that there is so very little written on the cost of capital -- its determination, and its role in public investment programs. This situation is changing today, however. With the advent of program budgeting for public agencies, a great deal more attention is being paid to cost effective planning. In that a proper discount rate is imperative to a benefit cost analysis, be it in financial or in broader socio-economic terms, there will be more literature dealing with the question of how the cost of capital should be calculated for a government project, or, for that matter, for any existing committed user of government funds.

The classic rate employed to evaluate public projects, has been the interest rate on government debt. The logic is, of course, that this is the cost of raising funds to the government. For two reasons, however, such a prevailing interest rate is less than ideal as a cost of capital as we defined it above: 1) as Quirin points out "the government bond rate does not contain within it an allowance for the riskiness of the particular project" E-53, 2) current debt rate in no way represents the social cost of capital committed to a project. "A more accurate measure of the social cost--is the marginal productivity of capital in the sector from which it is withdrawn" E-53. In other words, just as in the private firm, the required yield must be that rate of return on alternate uses of funds foregone in favour of the project or user analysed. In the case of a firm, it is the shareholders opportunities and interests that must be considered: in the public case, it is the tax payers and lenders.

If one were to attempt to arrive at the ideal social discount rate, or cost of capital, not only would one find it a frustrating endeavour but the results would undoubtedly be imperfect. First, it is necessary to consider the source from which the funds to be used by the government (and subsequently invested in the university) would in fact be drawn. It can be assumed that the government would be using either tax funds or borrowed funds. If the assumption were made that the university oriented funds were to come solely from tax revenues it would be necessary to identify the sectors from which the funds would be drawn, that is, an examination of the tax structure to see which portions of revenue are derived from specific taxes. By looking at the alternate uses of those tax funds (i.e. the private opportunity rates of return in each sector) an average marginal cost of the total funds could be constructed. In arriving at an average cost, the marginal cost of funds in each sector would be weighted according to its percentage contribution to the total fund.

Although most writers who have cared to write on the subject have discredited the above means for calculating a public cost of capital, the respected Professor Eckstein holds to it as the only theoretical accurate method. Quirin summarizes the major objection very simply, as follows: "...not enough is known about tax incidents to make possible any degree of precision in the estimates of weights" (E-53). Quirin imparts as well a compelling thought. If a project is to be financed by tax revenues, the best alternative to use as the cost of capital would be the marginal rate of return to the most productive sector. As he says, "...the fact that the portion of the funds are derived from a sector in which they are relatively unproductive, is not sufficient justification for utilizing them to carry slightly better projects while there are more worthwhile uses for the funds available" E-53. What he says is certainly in line with the opportunity cost concept but it is hardly practical. It would seem indeed difficult to justify any public project or any use of government funds if the required return was the same as that in the nation's most profitable industry or region.

If one were to consider that an entity such as a university was financed totally and indirectly by borrowed funds, again it would not be realistic to apply the interest rate on government debt. From an opportunity cost standpoint, it would be immensely fairer to examine the capital market and attempt to gather the following information:

- 1) Assuming that there are constraints on the amount of debt funds available in the economy, who (i.e. which sectors of the domestic market) had to forego funds in their own borrowing program as a result of the government bond issue?
- 2) What is the marginal opportunity rate of return in each sector?

The problem with the use of weighted tax payers' cost and the opportunity cost to indirect lenders is that both approaches must be predicated on accurate tax and economic data, and an established system of collecting such data on a continuing basis. Unfortunately, data of the precision that would be required are just not available.

One is left therefore, in the rather weak but practical position of suggesting the use of the 1968 government bond rate -- 7%. Another justification for 7% might be that it is the after tax rate for a sector or firm exhibiting a 14.6 return on investment before taxes. In that this is a reasonably high rate of return we would hesitate to suggest that 7% be used as a minimum rate. The following table which contains information on service industries tends to reinforce our feeling that 7% is not as unreasonably low a rate as was felt at first.

#### SELECTED CORPORATE RATIOS

TABLE B-6

Industry	% Return on Invested Capital
Air Transport	9.8
Water Transport	7.2
Railways	3.4
Truck Transport	13.2
Pipeline	9.2
Telephones	5.6
Electric Power	5.6
Gas Distribution	4.9
Total Transportation	5.6
Total Utilities	5.2
Total Communication	6.0

Source: F-37 "Selected Corporate Ratios Based on Taxation Statistics for the Year 1964", Commercial Letter, Canadian Imperial Bank of Commerce, May 1967.

#### TIME (1)

The student, by his attendance in a post-secondary institution foregoes earnings. That is, if a student spends 30 weeks at school when he might otherwise be working, he is giving up 30 weeks of income.

The approach taken here is that all opportunity costs are relative to the earnings of the high school graduate who chose not to enter into Post-Secondary Education. For the graduate student, this perhaps is unrealistic. His control group might well be argued to be the cohort of employees with whom he shared his undergraduate training. As this phase of the study was limited to  $m=3$ , there is no problem. It is strongly advocated, however, that this approach should be the operational one when a more complete set of data is used.

TIME (1) - a portion of earnings foregone is constructed as follows:

Assume an average work week of 40 hours for 50 weeks per year; i.e., assume a 2000 hour work period per year. Further assume that the student can only work for a portion of his summer vacation. The fraction chosen is up to the analyst. Its value should reflect the degree of oversupply in the labour market due to the large influx of students into the labour force. It should, as well, reflect the current economic conditions. If all courses are assumed to run for an average of 30 weeks, that only 50% of the summer vacation is spent not at work, then

$$\text{TIME (1)} = \frac{30 \times 40 + 10 \times 40}{50 \times 40} = 80\% = \underline{.8}$$

The final computation is to add 80% of the high school graduate's (of age  $j$ ) earnings to the cost of the Post-Secondary student (of age  $j$ ). It should be stated that although certain training, such as architecture lends itself to part-time jobs (draftsmen in the case of architects) these jobs are over and above the 40 hour school week and hence are not included. A further refinement, not introduced in this phase, is to discover how sensitive the probability of graduating is to working part-time while at school.

In this fashion, the opportunity cost of Post-Secondary Education could be lowered if one were to find that for certain courses, and for certain students, the entire 40 hours need not be taken up by school work. That this is the case is fully expected.

In any case, the range of TIME (1) depends on the percentage of the summer occupied not at work. As this fraction ranges from 0% to 100%, then TIME is bounded by 60% to 100%; i.e.

$$\frac{40 (30 + x.20)}{2000}$$

where  $0 < x < 1$  for  $x$  equal to the fraction of the summer spent not at work.

## B.2 Costing of Programs and Degrees per Student

There are three tables presenting the results of re-distribution of the Trial Balance allocations and receipts INST(H,U) & SOCI(H,U) into particular programs (I) and academic years (J), through temporary cost matrices TEMP(H,I,J).

### B.2.1 Definitions

Intermediate Results (1):

- set up cost matrices TEMP(H,I,J) -

$$\begin{aligned} \text{If } H = 1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, \\ 35, 36, 37 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{FMWT}(I, J) / [\sum_{IJ} \text{PROG}(I, J) * \text{FMWT}(I, J)]} \end{aligned}$$

$$\begin{aligned} \text{If } H = 3, 30, 32 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{FEES}(I, J) / [\sum_{IJ} \text{PROG}(I, J) * \text{FMWT}(I, J)]} \end{aligned}$$

$$\begin{aligned} \text{If } H = 4, 31 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{EQIP}(I, J) / [\sum_{IJ} \text{PROG}(I, J) * \text{EQIP}(I, J)]} \end{aligned}$$

$$\begin{aligned} \text{If } H = 5, 6, 26, 27 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{LOAN}(I) / [\sum_{IJ} \text{PROG}(I, J) * \text{LOAN}(I)]} \end{aligned}$$

$$\begin{aligned} \text{If } H = 7 \text{ \& } J = 7, 10, 11, 12, 14, 15, 16 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{FELL}(I) / [\sum \text{PROG}(I, J) * \text{FELL}(I)]} \end{aligned}$$

$$\begin{aligned} \text{If } H = 8, 9, 10, 28, 29 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) /}{/ \sum \text{PROG}(I, J)} \end{aligned}$$

$$\begin{aligned} \text{If } H = 33, 34 \\ \text{TEMP}(H, I, J) = \frac{\text{CATE}(H) * \text{RATE}(H) * \text{PROG}(I, J) *}{* \text{FRGO}(I, J) * \text{TIME}(1) /}{/ [\sum \text{PROG}(I, J) * \text{FRGO}(I, J) * \text{TIME}(1)]} \end{aligned}$$

## Intermediate Results (2):

- select and deposit appropriate costs -

$$\text{TINC}(I,J) = \sum_{H=9,11,17,18,19,35} \text{TEMP}(H,I,J) - \sum_{H=36,37} \text{TEMP}(H,I,J)$$

$$\text{TGOC}(I,J) = \sum_{H=1,5,6,7,12,13,21,22,23,25,26,27,29,32,34,36,37} \text{TEMP}(H,I,J) - \sum_{H=18} \text{TEMP}(H,I,J)$$

$$\text{TSTC}(I,J) = \sum_{H=3,4,30,31,33} \text{TEMP}(H,I,J) - \sum_{H=5,6,7,9,10,32,34} \text{TEMP}(H,I,J)$$

$$\text{TECC}(I,J) = \sum_{H=2,8,10,14,15,16,24,28} \text{TEMP}(H,I,J) - \sum_{H=19,25,29} \text{TEMP}(H,I,J)$$

$$\text{TSOC}(I,J) = \text{TGOC}(I,J) + \text{TSTC}(I,J) + \text{TECC}(I,J)$$

$\text{TINC}(I,J)$  - TOTAL INSTITUTION COST

$\text{TGOC}(I,J)$  - TOTAL GOVERNMENT COST

$\text{TSTC}(I,J)$  - TOTAL STUDENT COST

$\text{TECC}(I,J)$  - TOTAL COST OF THE REST OF THE ECONOMY

$\text{TSOC}(I,J)$  - TOTAL SOCIETAL COST

## Output:

(1) Institutional Cost per Student, Program & Ac. Year

$\text{YEAR}(I,J)$  - AVERAGE INSTITUTIONAL COST

is the average cost incurred by the institution per one student enrolled in a particular program (I) and academic year(J)

$$\text{YEAR}(I,J) = \text{TINC}(I,J) / \text{PROG}(I,J)$$

(2) Societal Cost per Student, Program & Ac. Year

$\text{YEAS}(I,J)$  - AVERAGE SOCIETAL COST

is the average cost incurred by the society (through its sectors) per one student enrolled in a particular program (I) and academic year(J)

$$\text{YEAS}(I,J) = \text{TSOC}(I,J) / \text{PROG}(I,J)$$

### (3) Estimated Institutional Cost of a Degree

DEGR(I,J) - ESTIMATED COST OF A DEGREE PER PROGRAM

is the sum of average institutional costs YEAR(I,J), regarding the appropriate length of program(J) and adjusted by pass rates PASS (I,J), i.e. per one student graduated from the program (I).

$$DEGR(I,J) = \left[ \sum_J TINC(I,J) / PROG(I,J) \right] / \prod_J PASS(I)$$

#### B.2.2. Input Variables

CATE(H) -- EXPENDITURE CATEGORY (see p. B-5)  
EQIP(I,J) - ACADEMIC EQUIPMENT COST (see p. B-18)  
FELL(I) - PROPORTION OF TOTAL FELLOWSHIPS THAT EACH PROGRAM RECEIVES  
FEES(I,J) - ACADEMIC FEES  
FRGO(I,J) - FOREGONE STUDENT ANNUAL EARNINGS (see p. B-21)  
FMWT(I,J) - FORMULA FINANCING WEIGHT D.U.A.  
LOAN(I) - PROPORTION OF TOTAL LOAN EXPENDITURES REIMBURSED IN FAVOUR OF EACH PROGRAM  
PASS(I,J) - TRANSITION RATE BETWEEN AC. YEARS  
PROG(I,J) - PROGRAM ENROLMENT (see p. B-26)  
RATE(H) - RATE APPLIED TO EXPENDITURES (see p. B-26)  
TIME(I) - PERCENTAGE OF FOREGONE EARNINGS (see p. B-35)

FEES(I,J)

For this phase of the study, standard fees have been established for each of the program classifications. The actual figures used are listed in the accompanying Table B-7.

FELL(I)

This is the vector of institutional specific values. See CATE(7) P. C-24.

TABLE B-7

I	J	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
01		475	475	475	475	475	475	475	475	-	133	133	400	-	60	133	400	-
02		650	650	650	650	650	650	650	650	-	133	133	400	-	60	133	400	-
03		480	480	480	480	480	480	480	480	-	247	247	495	-	60	133	400	-
04		655	655	655	655	655	655	655	655	-	133	133	400	-	60	133	400	-
05		545	545	545	545	545	545	545	545	-	133	133	400	-	60	133	400	-
06		480	480	480	480	480	480	480	480	-	133	133	400	-	60	133	400	-
07		505	505	505	505	505	505	505	505	-	133	133	400	-	60	133	400	-
08		475	475	475	475	475	475	475	475	-	133	133	400	-	60	133	400	-
09		485	485	485	485	485	485	485	485	-	133	133	400	-	60	133	400	-
10		485	485	485	485	485	485	485	485	-	245	245	495	-	60	133	400	-
11		-	-	490	490	490	490	490	490	-	133	133	400	-	60	133	400	-
12		460	460	460	460	460	460	460	460	-	133	133	400	-	60	133	400	-
13		495	495	675	675	675	675	675	675	-	133	133	400	-	60	133	400	-
14		490	490	490	490	490	490	490	490	-	133	133	400	-	60	133	400	-
15		465	465	465	465	465	465	465	465	-	157	157	470	-	60	133	400	-
16		490	490	490	490	490	490	490	490	-	133	133	400	-	60	133	400	-
17		490	490	490	490	490	490	490	490	-	133	133	400	-	60	133	400	-
18		490	490	490	490	490	490	490	490	-	125	125	375	-	60	133	400	-
19		480	480	480	480	480	480	480	480	-	200	200	400	-	60	133	400	-
20		475	475	475	475	475	475	475	475	-	133	133	400	-	60	133	400	-
21		400	400	400	400	400	400	400	400	-	200	200	600	-	60	133	400	-
22		480	480	480	480	480	480	480	480	-	133	133	400	-	60	133	400	-
23		-	480	480	480	480	480	480	480	-	133	133	400	-	60	133	400	-
24		485	485	485	485	485	485	485	485	-	133	133	400	-	60	133	400	-
25		-	485	485	485	485	485	485	485	-	133	133	400	-	60	133	400	-
26		490	490	490	490	490	490	490	490	-	125	125	375	-	60	133	400	-
27		-	-	-	-	-	-	-	-	-	337	337	675	-	60	133	400	-
28		650	650	650	650	650	650	650	650	-	133	133	400	-	60	133	400	-
29		-	-	-	-	-	-	-	-	-	252	252	505	-	60	133	400	-
30		400	-	-	-	-	-	-	-	-	133	133	400	-	60	133	400	-
31		480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32		480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33		490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34		465	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35		490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36		485	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37		250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38		420	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39		475	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40		250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41		480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43		150	150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44		150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45		150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46		150	150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47		150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48		150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49		150	150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50		150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

FEES (I,J)

TABLE B-7 (Cont'd)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
51	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	330	330	-	133	133	400	-	60	133	400	-
66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
74	321	321	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	321	321	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	321	321	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	321	321	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sources: F-3 Institutional Enrolment Report UA-3, p. 1-6,  
Ontario Department of University Affairs, Toronto

F-10 Horizons, A guide to educational opportunities in  
Ontario for 1968-69 beyond the secondary school  
level, Ontario Department of University Affairs,  
Toronto, 1968.



J I	1	2	3	4	5	7	8	9	10	11	12	14	15	16
55	1.00													
56	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
57	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
58	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-
60	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-
61	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-
62	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
63	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-
64	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	2.00	0.33	-	1.00	4.00	0.80	1.00	6.00	1.20
66	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
71	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
72	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
73	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
74	0.80	0.80	0.80	-	-	-	-	-	-	-	-	-	-	-
75	1.00	1.00	1.50	-	-	-	-	-	-	-	-	-	-	-
76	0.80	0.80	0.80	-	-	-	-	-	-	-	-	-	-	-
77	2.00	2.00	2.00	-	-	-	-	-	-	-	-	-	-	-

Sources: F-7 "A Formula for Operating Grants", Report of the Minister of University Affairs, Ontario Dept. of University Affairs, Toronto, 1969, p 98.

F-11 "Proposed Operating Grant Formula", Memorandum of the Ontario Department of Education to CAAT's and Ryerson Politechnical Institute, Toronto, November 6, 1970.

## FMWT(I,J)

Some factors are required for application to the relevant program enrolments in the segments of the project where institutional cost is distributed among the various programs offered by each institution. Ideally, these weights would represent the comparative usage of institutional resources originating from each program and year. By incorporating such resource-use indices into the model, distributional effects with respect to costing for varying program mixes can be considered.

For the universities, formula weights as used by DUA have been used. For the CAAT's, weights developed by DE. These weights have been established as an

objective means of distribution educational aid to the institutions and were intended, in an approximate fashion, to mirror the relative cost structure among programs. Research is currently being carried on regarding unit costs at the university level by AUCC, CAUBO, and CAUT. <sup>E-105</sup> When these results are available better figures can perhaps be used.

For the universities, these are the "formula fees" as used by DUA appearing on their UA-3 form. For the CAAT's, a standard \$150 annual tuition figure has been used. Consultation with SRG people working on CAAT's projects provided ball-park values for the special CAAT's programs, while the DUA publication Horizons (F-10) is the source of remaining data.

The fee actually charged is known to vary among the different institutions of the same class, and this is a refinement which can readily be introduced in a future phase. The specific fees that each institution sets for its programs lend itself to experiments regarding the effects of differential user charges.

Presently, fees vary only by level of instruction between undergraduate and graduate education.

Notes: - the standard Architecture (02UG) fee was inputed to the Landscape Architecture program (27UG)  
- likewise the standard Technology Course (32 Diploma only) fee was inputed to the Nursing Technology (28 Diploma only) program.

#### LOAN(I)

This is the vector of program specific values 953, for I=13 & 42,1354, for I=4, 1053. See CATE(5) p. C-19

#### PASS(I,J)

One important group of factors involved in this study are the pass-fail rates for the various forms of Post-secondary Education, as they determine the cost to produce a graduate from the various programs.

Unfortunately, information on pass-fail rates is sadly lacking. It is needed by program and level to be useful for the type of analysis that is desired. Accordingly, values have been determined to facilitate analysis for this phase of the study. A number of methods have been used to determine these figures, but because the data is not yet in final reliable shape from the point of view of being perfectly accurate, no inter-institutional performance comparisons based upon it should be made.

Where possible, actual values of pass-fail rates are used, and this is the case with the teachers' colleges and nursing schools. When actual figures were not available, sample survey results were referred to. One further method yielded results.

Often at an institution, the enrolment in a program at successive levels remained fairly constant over the years. When this was the case, the decrease in program size from year-to-year was associated with a failure rate. In this way, pass rates for a number of specific courses were imputed. This is referred to as the comparative cohort method.

To carry out this procedure, certain aggregation was done where large-scale transferals were known to exist, but not the size of them. This is the case passing from 1st year to 2nd in both Arts and Science, as well as going from 3rd to 4th. First year is common; the break-out from it into the honours and general stream varies greatly. Further, there are important but unquantified shifts each year between them. Accordingly, we have an average pass-fail rate for each of the two aggregated courses.

Methods of Determination of PASS rates:

UNIVERSITIES:

Values for pass rates were determined for the universities in 3 ways:

- (i) using the cohort comparison method upon 1968-1969 enrolment data.
- (ii) from sample survey sources
  - E-23 Fleming, W.G.: "Characteristics and Achievement of Students in Ontario Universities, Report #11", Atkinson Study of Utilization of Student Resources, O.I.S.E., Toronto. (values appear underlined)
  - E-118 Registrar's Report 1967-1968, McMaster University, 1969 (values appear encircled)
- (iii) comparing similar courses

## Assumptions:

- (i) In general, third year pass rate is assumed to be .95.
- (ii) When rates for a program are taken at discretion as the same as those from another institution, the institution's name is given - generally one from the same grouping is used, but sometimes a selection from the same grouping is not possible, (nor even any selection).

UNIVERSITY GROUPINGS ACCORDING TO THEIR MATURITY

MATURE, DEVELOPED	DEVELOPING	EMERGENT
CARLETON McMASTER OTTAWA QUEEN'S U. of T. UN. of WATERLOO UN. of WESTERN ONTARIO	GUELPH WATERLOO LUTHERAN WINDSOR YORK	BROCK LAKEHEAD LAURENTIAN TRENT

Source: Criteria -

- (i) years the institution has been established
- (ii) variety of programs offered, especially presence of professional faculties
- (iii) size
- (iv) developed graduate school

COLLEGES OF APPLIED ARTS AND TECHNOLOGY

SRG experience on CAAT's project

TEACHERS COLLEGES

This is the area of the most exact transition data and the actual 1968-1969 pass-fail rates were used.

## NURSING SCHOOLS

The figures used were derived from actual data provided by the institutions. However, since the data are not from a study year consistent with 67-68 financial data, the rates may not be as ideal as if otherwise obtained. As well, there are obvious inconsistencies in the reporting. Accordingly, these values should be considered as questimates founded upon the available information.

For phase two and on, we will want to study a number of matters ignored for the first endeavour.

- (i) institution-specific pass-fail rates by program, especailly for the graduate area, untouched by this phase.
- (ii) program cross-overs, and their associated cost-effects.
- (iii) the withdrawal component to "failures" and the reasons for it.
- (iv) geographic origin and destination of students, passing and failing.

### B.3 Enrolment

This table shows the total enrolment by program (I) and grand total by institution (S) in terms of full-time equivalent. Course registrations (J = 9,13,17) are not counted.

#### B.3.1 Definitions

Output:

$$(1) \text{ PROG (I) } = \sum_J \text{ PROG (I,J) * FTE(J)}$$

$$J = 1,2,3,4,5,6,7,8,10,11,12,14,15,16$$

$$(2) \text{ PROG (S) } = \sum_{IJ} \text{ PROG (I,J) * FTE(J)}$$

#### B.3.2 Input Variables

FTE (J) - FULL-TIME EQUIVALENT (Internal variable)  
 PROG(I,J) - PROGRAM ENROLMENT (See p. B-26)

FTE(J)

#### FULL-TIME EQUIVALENT WEIGHTS

TABLE B-9

Academic Year (J)	Weight
1,2,3,4,5,6,7,10,11,14,15	1.000
8	0.166
12,16	0.200

Source: F-7 Report of the Minister of  
 University Affairs of Ontario  
 1967-1968 (p.102), ODU, A,  
 Toronto, 1969.

#### B.4 Costing of the Medical Programs

A study of the costs of graduates in medicine must consist of two relatively separate tasks:

- (1) costing of classroom teaching, and
- (2) costing of hospital teaching.

Only the second task remains to be described since the costs of classroom teaching are generated by the regular cost model and the table "Institutional Cost Per Student, Program and Academic Year" provides sufficient information (see variable YEAR (I,J), Section B.2).

In order to be absolutely consistent with the general model, the information on hospital teaching costs has been produced in exactly the same form i.e. through the Trial Balance and the subsequent tables.

For this reason we have established four "quasi" institutions (or aggregates):

- 901 SCHOOLS OF MEDICINE
- 902 SCHOOLS OF DENTISTRY
- 903 SCHOOLS OF NURSING (University)
- 904 SCHOOLS OF NURSING

Thus we were able to generate four sets of tables, in the same fashion as for all other institutions, providing all information about expenditures incurred due to the hospital teaching. However, the trial balances (hospital teaching) have fewer cost categories CATE (H) than classroom teaching trial balances because this costing deals only with the additional expenditures. Explicitly, the trial balances (hospital teaching) consist of CATE<sup>1</sup>(H) defined for  $H = \underline{1, 11, 17, 22, 35, 36, 37}$  (See TABLE B-10, p. B-53).

##### B.4.1 Definitions

Entries:

Trial Balance (Hospital Teaching)

If  $H = \underline{1, 36, 37}$

$CATE^1(H) * RATE(H) = INST(H, 2) \& GOVT(H, I) \& SOCI(H, 1)$

If  $H = 11, 17, 35$

$$CATE^1(H) * RATE(H) = INST(H, 1)$$

If  $H = 22$

$$CATE^1(H) * RATE(H) = GOVT(H, 1) \& SOCI(H, 1)$$

Intermediate Results:

The procedures leading to the values of  $CATE^1(H)$  are described in section B.4.2

Output:

(1) Trial Balance (Hospital Teaching)

$$\sum_{IJ} \frac{TINC^1(I, J) - \text{TOTAL INSTITUTIONAL (HOSPITAL) COST}}{IJ}$$

$$\sum_{IJ} \frac{TGOC^1(I, J) - \text{TOTAL GOVERNMENT (HOSPITAL) COST}}{IJ}$$

$$\sum_{IJ} \frac{TSOC^1(I, J) - \text{TOTAL SOCIETAL (HOSPITAL) COST}}{IJ}$$

For formulae see B.1.1 p.B-2

(2) Institutional Cost per Student, Program and Ac. Year

$YEAR^1(I, J) - \text{AVERAGE INSTITUTIONAL (HOSPITAL) COST}$   
is the average cost incurred by all affiliated teaching hospitals, per one student enrolled in a particular program (I) and ac. year (J).

(3) Societal Cost per Student, Program & Ac. Year

$YEAS^1(I, J) - \text{AVERAGE SOCIETAL (HOSPITAL) COST}$   
is the average cost incurred by the society (through its sectors) per one student enrolled in a particular program (I) and academic year (J), regardless of the number of contact hours.

(4) Estimated Hospital (Additional) Cost of a Degree

$DEGR^1(I, J) - \text{ESTIMATED COST OF A DEGREE PER PROGRAM}$   
is the sum of average institutional costs  $YEAR(I, J)$ , regarding the appropriate length of program (J) and adjusted by pass rates  $PASS(I, J)$ , i.e. per one student graduated from the program (I), regardless of the number of contact hours.

(5) Enrolment

$PROG^1(I)$  - PROGRAM ENROLMENT  
is the sum of all year partial enrolments

(6) Enrolment and Contact Hours

$TCNC(I,J)$  - TOTAL CONTACT CLASSROOM HOURS  
is the product of enrolment and contact classroom hours

$$TCNC(I,J) = PROG(I,J) * CONC(I,J)$$

$TCNH(I,J)$  - TOTAL CONTACT HOSPITAL HOURS  
is the product of enrolment and contact hospital hours

$$TCNH(I,J) = PROG(I,J) * CONH(I,J)$$

(7) Institutional Cost

$CLIN(I,J)$  - INSTITUTIONAL CLASSROOM COST PER YEAR  
this is a relevant portion of the sum of average institutional costs with regard to the product of enrolment and classroom contact hours.

$$CLIN(I,J) = \left[ \sum_J YEAR(I,J) * PROG(I,J) \right] / \sum_J TCNC(I,J) * \left[ CONC(I,J) * PROG(I,J) \right]$$

$YECR(I,J)$  - CLASSROOM COST PER STUDENT, PER YEAR  
this is a relevant portion of the sum of average institutional costs with regard to the classroom contact hours

$$YECR(I,J) = CLIN(I,J) / PROG(I,J)$$

$HOIN(I,J)$  - INSTITUTIONAL HOSPITAL COST PER YEAR  
this is a relevant portion of the sum of average institutional costs with regard to the product of enrolment and hospital contact hours

$$HOIN(I,J) = \left[ \sum_J YEAR^1(I,J) * PROG(I,J) \right] / \sum_J TCNH(I,J) * \left[ CONH(I,J) * PROG(I,J) \right]$$

$YEHR(I,J)$  - HOSPITAL COST PER STUDENT, PER YEAR  
this is a relevant portion of the sum of average institutional costs with regard to the hospital contact hours

$$YEHR(I,J) = HOIN(I,J) / PROG(I,J)$$

$TTIN(I,J)$  - INSTITUTIONAL TOTAL COST PER YEAR  
is a sum of institutional classroom and hospital costs

$$TTIN(I,J) = CLIN(I,J) + HOIN(I,J)$$

$TSTH(I,J)$  - TOTAL COST PER STUDENT, PER YEAR  
is the sum of classroom and hospital costs

$$TSTH(I,J) = YECR(I,J) + YEHR(I,J)$$

#### (8) Societal Cost

$YECS(I,J)$  - SOCIETAL CLASSROOM COST PER STUDENT, PER YEAR  
 $YEHS(I,J)$  - SOCIETAL HOSPITAL COST PER STUDENT, PER YEAR  
 $TSOH(I,J)$  - SOCIETAL TOTAL COST PER STUDENT, PER YEAR  
 $CLSO(I,J)$  - SOCIETAL CLASSROOM COST PER YEAR  
 $HOSO(I,J)$  - SOCIETAL HOSPITAL COST PER YEAR  
 $TTSO(I,J)$  - SOCIETAL TOTAL COST PER YEAR

The formulae are analogical to those as stated in the previous paragraph (7)

#### (9) Degree Cost

$TDEG(I)$  - TOTAL DEGREE COST  
is the sum of classroom and hospital degree costs

$$TDEG(I) = DEGR(I) + DEGR^1(I)$$

#### B.4.2 Input Variables

$CATE^1(H)$  - EXPENDITURE CATEGORY (HOSPITAL)  
 $CONC(I,J)$  - CLASSROOM CONTACT HOURS  
 $CONH(I,J)$  - HOSPITAL CONTACT HOURS  
 $DELT(1)$  - INFLATION FACTOR  $(1 + \delta)$   
 $PROG(I,J)$  - PROGRAM ENROLMENT (see p. B-36)  
 $RATE(H)$  - RATE APPLIED TO EXPENDITURE (see p. B-29)

TRIAL BALANCE CATEGORIES  
(HOSPITAL TEACHING)

TABLE B-10

CATE<sup>1</sup>(H)

OUT-OF-POCKET COSTS

- 1. Government Operating Grants
- 11. Instit.Net Expendit's
- 17. Depreciation

Subtotals --  
Surplus (Deficit) Application  
BALANCE --

OPPORTUNITY COSTS

- 22. Government Operat.Grants
- 35. Inst.Employed Capital
- 36. Loss of Corpor.Tax
- 37. Loss of Property Tax

Subtotals --  
Surplus (Deficit) Application  
BALANCE --

TOTALS  
BALANCE

CATE<sup>1</sup>(1) GOVERNMENT OPERATING GRANTS

Sources: primary source: F-5  
intermediate form: F-72-26

Allocation: GOVERNMENT, SOCIETY

Receipt: INSTITUTION

These grants represent the reimbursement of the part of the teaching hospital current expenditures, attributable to the educational program as stated in the CAUBO Report (F-5 p.54). This expense is shared by the Department of Health and Department of University Affairs, roughly on the 50/50 basis (E-114). It has been assumed that

CATE<sup>1</sup>(1) = CATE<sup>1</sup>(11)

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E-114 Health Sciences Educational Planning and Budgeting Models, Health Sciences Functional Planning Unit, p.18, University of Toronto, 1970.

CATE<sup>1</sup>(11) INSTITUTIONAL NET EXPENDITURES

Sources: primary source: F-5  
intermediate form: F-72-26

Allocation: INSTITUTION

Receipt:

The total amount of the institutional expenditures contains only the items relevant to the educational programs of the teaching hospital.

Since the 1969 Annual Returns (F-5) state all expenditures as at December 31, 1969 while the cutoff date of this study is June 30, 1969 there was necessary to adjust the provided data for half a period - by means of multiplier 0.96225 - see DELT (1).

For Schools of Medicine and Nursing Schools (non-university) the data were available immediately.

For Schools of Dentistry and Schools of Nursing the data had to be estimated on the basis of hospital contact hours. It has been assumed, that the cost of one contact hour for dentistry students and medicine students are equal and the cost of an undergraduate nursing student contact hour equals that of non-university nursing students.

CATE<sup>1</sup>(17) DEPRECIATION

Sources: primary source: F-13, F-23, F-25  
intermediate form: F-72-30/7

Allocation: INSTITUTION

Receipt: -

This is an INTERNAL transaction of the institution. The amount is the lump sum of the book values of buildings, equipment and constructions in progress and creates a basis for depreciation charges.

Depreciation is a process of allocation and represents the transformation of fixed assets into cash. In other words, it distributes the cost of fixed assets over their estimated useful life. For our purposes, the buildings are assumed to have a 40 year life, equipment and a 5 year life.

For more details see CATE<sup>1</sup>(35), step (4).

SUBTOTALS 1

These are actual expenditures which have already been paid or received by each sector of the economy and by the institution.

SURPLUS (DEFICIT) APPLICATION TO INST.FUNDS

Source: SUBTOTALS 1

Allocation: SURPLUS (INSTITUTION)

Receipt: DEFICIT (INSTITUTION)

This is an INTERNAL transaction of the institution. A DEFICIT means that the difference between receipts and allocations was financed from other institutional funds, i.e. from existing assets and other current income (miscellaneous, receipts from service to outside interest on capital funds, sales of capital assets etc.) A SURPLUS contributes to these funds. Particular notice should be given to the interpretation of this deficit or surplus. We emphasize that these are NET RESULTS associated with the EDUCATIONAL PROCESS. This means that a deficit can be compensated by other incomes (specified above) which are considered as a result of business activities of the institution, but not necessarily part of the educational programs.

BALANCE 1

Shows how much the hospital teaching provided by the institution or affiliated hospital costs, how much has been paid by societal funds and the extent of participation by the economy sectors on these costs.

CATE<sup>1</sup>(22) GOVERNMENT OPERATING GRANTS

Sources: CATE (1)

Allocation: GOVERNMENT, SOCIETY

Receipt:

This cost is created by the application of capital to educational operations. This is an INTERNAL transaction of the government. The opportunity cost is computed similarly to the foregone earnings under the assumption that the capital could have been applied to the purchase of Canada Savings Bonds.

CATE<sup>1</sup>(35) INSTITUTIONAL EMPLOYED CAPITAL

Source: primary source: F-13, F-23, F-25  
intermediate form: F-72-14/7

Allocation: INSTITUTION

Receipt: -

This is an INTERNAL transaction of the institution. Hospital Statistics of DBS (F-23 & F-25) provide all necessary information about the capital stock and both total and educational expenditures incurred by Ontario public hospitals, as at December 31, 1968. Since the cutoff date of this study is June 30, 1969 there was firstly necessary to adjust all data for a half a period - by means of multiplier 1.03923 - see DELT (1).

In order to obtain the relevant portion of the lump sum stated capital which could be allocated into the particular programs, the next steps were followed:

1. The capital/expenditure ratios (which are the portions of particular assets per one dollar of total expenditures has been computed. See TABLE B-12.
2. The affiliation of hospitals providing the hospital teaching in medicine, dentistry, nursing (university and non-university) has been found or assumed on the regional basis. So that four groups of hospitals have been created.
3. The appropriate expenditures incurred by each of those hospitals due to educational services (F-13) have been multiplied by the ratios mentioned in (1) so that the standard balance sheets (F-71) were set up (for each of those hospitals).
4. The close the book operation was performed on each of those balance sheets and EMPLOYED CAPITAL (line 31), BASIS FOR DEPRECIATION (line 25) and BASIS FOR PROPERTY TAX (line 22) have been computed.
5. An aggregation of these three items followed within each of the mentioned four groups of hospitals and forms F-72's have been generated.

# ONTARIO HOSPITAL EXPENDITURES

B-7

TABLE B-11

Expenditures		December 31, 1968				June 30, 1969
		Table		%	Amount	
		7	14			
1	2	3	4	5	6	7
1	Total Expenditures	x		100	650,658,938	676,184,288
2	Supplemental Services	x		6.6	42,940,151	44,624,693
3	Nursing Education		x		21,733,113	22,585,703
4	Medical Education		x		12,353,143	12,837,756

Source: F-23 Hospital Statistics, Volume VI, "Hospital Expenditures 1968" Tables 7 & 14, Cat.No. 83-215, DBS, 1970.

# ONTARIO BALANCE SHEET OF PUBLIC HOSPITALS

TABLE B-1

Assets		December 31, 1968				June 30, 1969	Cap/Exp ratio	Sink (SRG form
		Table		%	Amount			
		1	5					
1	2	3	4	5	6	7	8	9
1	Revenue Fund	x			101,580,404	105,565,403	0.156119	F-71/1
2	Capital Fund	x		100	860,518,289	894,276,422	1.322533	F-71/2
3	Land		x	3.6	30,978,658	32,193,951	0.091116	F-71/21
4	Buildings & Land Improvements		x	59.4	511,147,864	531,200,195	0.785584	F-71/22
5	Major & Minor Equipment		x	13.2	113,588,414	118,044,488	0.174574	F-71/23
6	Construction in Progress		x	8.3	71,423,018	74,224,943	0.109770	F-71/24
7	Endowment Fund	x			59,285,214	61,610,973	0.047611	F-71/3

Source: F-25 Hospital Statistics, Volume IV, "Balance Sheets 1968", Table 1 Tables 1 & 5 Cat.No. 83-213, DBS, 1970.

CATE<sup>1</sup>(36) LOSS OF CORPORATION TAXSource: CATE (35)Allocation: GOVERNMENT, SOCIETYReceipt: INSTITUTION

This transaction re-distributes the taxable part of the foregone earnings CATE (35) with regard to the capital employment in the hospital teaching.

CATE<sup>1</sup>(37) LOSS OF PROPERTY TAX

Source: primary source:  
intermediate form: F-72-31/7

Allocation: GOVERNMENT, SOCIETYReceipt: INSTITUTION

See CATE (36). This foregone tax is computed from the book value of the land and buildings employed by the teaching hospital.

SUBTOTALS 2

Show the opportunity costs due to the educational expenditures in terms of out-of-pocket costs above, on the allocation sides of all accounts and simultaneously the re-distribution of these opportunity costs among the participating sectors.

SURPLUS (DEFICIT) APPLICATION TO INST. FUNDSSource: SUBTOTALS 2Allocation: SURPLUS - (INSTITUTION)Receipt: DEFICIT - (INSTITUTION)

This is an INTERNAL transaction of the institution. See SURPLUS (DEFICIT) following CATE (21).

BALANCE 2

Shows the additional cost incurred by the expenditures and capital stock in connection with hospital teaching, as well as the participation of the sectors of the economy in these costs.

# TOTALS

These are summations of all receipts, allocations and surplus (deficit) applications.

## BALANCE 3

Provides the final results, the TOTAL COST of hospital teaching paid and foregone (in rejecting other investment alternatives) by society and the major sectors of the economy.

DELT (1) =  $(1 + \delta)$  where  $\delta$  stands for the rate of inflation. The value of  $\delta$  was chosen 0.08. Then

$$\text{DELT}^{\frac{1}{2}} = 1.08^{\frac{1}{2}} = 1.03923$$

$$\text{DELT}^{-\frac{1}{2}} = \frac{1}{1.08^{\frac{1}{2}}} = 0.96225$$

CONC(I,J)

CONH(I,J)

## CONTACT HOURS

TABLE B-13

I J	04 DENTISTRY		13 MEDICINE		15 NURSING (U)		62 NURSING SCH.	
	Class room	Hosp- ital	Class- room	Hosp- ital	Class- room	Hosp- ital	Class- room	Hosp- ital
	CONC (4,J)	CONH (4,J)	CONC (13,J)	CONH (13,J)	CONC (15,J)	CONH (15,J)	CONC (62,J)	CONH (62,J)
1	N/A	-	N/A	-	468	-	528	288
2	819	-	N/A	-	384	164	504	480
3	707	104	1,107	-	264	284	N/A	N/A
4	536	609	618	224	144	144	-	-
5	160	775	372	630	-	-	-	-
6	-	-	126	759	-	-	-	-
TOTALS	2,222	1,488	2,223	1,613	1,260	592	1,032	768

# APPENDIX C

## INCOME REDISTRIBUTIVE EFFECTS MODEL

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## C. INCOME REDISTRIBUTIVE EFFECTS MODEL

### C.1 Federal Costs

This table shows the federal portion of the total governmental Allocations GOVT(H,U) distributed by program (I) and socio-economic strata (k), through the portion of the tax revenue fund FEDR(l,k) and the percentage of institutional operating grants (paid by the federal government) FPOR(l)

#### C.1.1 Definitions

Output:

FEDC(I,K) -  $\frac{\text{FEDERAL EDUCATIONAL COST}}{(\text{by program I, by socio-economic strata k})}$

If (H = 1,22,25,24,32,34)

$$\text{FEDC(I,K)} = \left[ \sum_H \text{TEMP(H,I,J)} * \text{FPOR(H)} \right] * \text{FEDR(I,K)}$$

If (H = 6,14,27)

$$\text{FEDC(I,K)} = \sum_H \text{TEMP(H,I,J)} * \text{FEDR(l,K)}$$

If (H = 21)

$$\text{FEDC(I,K)} = \text{TEMP(H,I,J)} * \text{FSAL(l,K)}$$

If (H = 36)

$$\text{FEDC(I,K)} = \text{TEMP(H,I,J)} * \text{FCOR(l,K)}$$

$$\sum_I \text{FEDC(I,K)}$$
 TOTAL FEDERAL EDUCATIONAL COST  
(by socio-economic strata k)

$$\frac{\sum_I \text{FEDC(I,K)}}{\sum_{IK} \text{FEDC(I,K)}}$$
 PERCENTAGE OF FEDERAL  
EDUCATIONAL COSTS  
(paid by socio-economic  
strata k)

#### C.1.2 Input Variables

See section C.7 p. c-5

## C.2 Provincial Costs

This table shows the provincial portion of total Governmental Allocations GOVT(H,U) distributed by program (I) and socio-economic strata (K), through the portion of the tax revenue fund PROV(l,K) and the percentage of institutional operating grants (paid by the provincial government) PPOR(I)

### C.2.1 Definitions

Output:

PROC(I,K) PROVINCIAL EDUCATIONAL COST  
(by program I, by socio-economic strata K)

If (H = 1,22,25,29,32,34)  

$$\text{PROC(I,K)} = \frac{\sum_H \text{TEMP(H,I,J)} * \text{PPOR(H)}}{H} * \text{PROV(l,K)}$$

If (H = 5,7,12,13,23,26,35)  

$$\text{PROC(I,K)} = \frac{\sum_H \text{TEMP(H,I,J)}}{H} * \text{PROV(l,K)}$$

If (H = 21)  

$$\text{PROC(I,K)} = \text{TEMP(H,I,J)} * \text{PSAL(l,K)}$$

If (H = 36)  

$$\text{PROC(I,K)} = \text{TEMP(H,I,J)} * \text{PCOR(l,K)}$$

If (H = 37)  

$$\text{PROC(I,K)} = \text{TEMP(H,I,J)} * \text{MUNC(l,K)}$$

$\sum_I \text{PROC(I,K)}$  TOTAL PROVINCIAL EDUCATIONAL COST  
I (by socio-economic strata k)

$\sum_I \text{PROC(I,K)} / \sum_{IK} \text{PROC(I,K)}$  PERCENTAGE OF PROVINCIAL  
I IK EDUCATIONAL COSTS  
(paid by socio-economic strata k)

### C.2.2 Input Variables

See section C.7 p. C-5

## C.3 Rest of the Economy Costs

This table shows the total of the Rest of the Economy Sector allocations REST(H,U) in distribution per program (I) and socio-economic strata (k), through taxation percentage shared by the particular strata. BUSI(l,K)

### C.3.1 Definitions

Output:

RECO(I,K) REST OF THE ECONOMY EDUCATIONAL COST

If (H = 2,8,10,14,15,16,24,28)  
$$RECO(I,K) = \sum_H TEMP(H,I,J) * BUSI(1,K)$$

$\sum_I RECO(I,K)$  REST OF THE ECONOMY EDUCATIONAL COST  
I (by socio-economic strata k)

$\sum_I RECO(I,K) / \sum_{IK} RECO(I,K)$  PERCENTAGE OF REST OF THE  
ECONOMY COSTS  
(paid by socio-economic  
strata k)

### C.3.2 Input Variables

See section C.7 p. C-5

## C.4 Student Costs

This table shows the total of the students Allocations  
STUD(H,U) in distribution per program (I) and socio-  
economic strata (K), through distributive coefficients  
GRDS(I,K) and PRIV(I,K)

### C.4.1 Definitions

Output:

STCO(I,K) STUDENT EDUCATIONAL COST  
(by program I, by socio-economic strata K)

If (H = 3,4,30,31,33)  
$$STCO(I,K) = \sum_H TEMP(H,I,J) * PRIV(I,K)$$
  
$$+ \sum_H TEMP(H,I,J) * GRDS(I,K)$$

$\sum_I STCO(I,K)$  STUDENT EDUCATIONAL COST  
I (by socio-economic strata K)

$\sum_I STCO(I,K) / \sum_{IK} STCO(I,K)$  PERCENTAGE OF STUDENT  
EDUCATIONAL COSTS  
(paid by socio-economic  
strata K)

#### C.4.2 Input Variables

See section C.7 p. C-5

### C.5 Societal Costs

This table shows the total of Societal Allocations SOCI(H,U) distributed by program (I) and socio-economic strata (K), which is the summation of the federal, provincial, rest of the economy and student allocations.

#### C.5.1 Definitions

Output:

SOCC(I,K) SOCIETAL EDUCATIONAL COST  
(by program I, by socio-economic strata K)

SOCC(I,K) = FEDC(I,K) + PROC(I,K) + STCO(I,K) + RECO(I,K)

$\sum_I$  SOCC(I,K) SOCIETAL EDUCATIONAL COST  
(by socio-economic strata)

$\sum_I \frac{SOCC(I,K)}{\sum_{IK} SOCC(I,K)}$  PERCENTAGE OF SOCIETAL  
EDUCATIONAL COSTS  
(paid by socio-economic strata K)

#### C.5.2 Input Variables

See section C.7 p. C-5

### C.6 Student Benefits

This table shows the total of both direct and indirect benefits received by students in various socio-economic strata through the coefficients GRDS(I,K) and PRIV(I,K) from all sectors of the provincial economy in terms of the relevant allocations of those sectors.

#### C.6.1 Definitions

Output:

STBE(I,K) STUDENT EDUCATIONAL BENEFITS

If (H = 1,2,7,8,10,12,...,16,22,...,25,28,29,32,24,...,37)  
 $STBE(I,K) = \sum_H TEMP(H,I,J) * PRIV(I,K)$

$STBE(I,K) = \sum_H TEMP(H,I,J) * GRDS(I,K)$

If (H = 5,26)  

$$STBE(I,K) = \sum_H TEMP(H,I,J) * GSAP(I,K)$$
  

$$STBE(I,K) = \sum_H TEMP(H,I,J) * OSAP(I,K)$$
  
  
 If (H = 6,27)  

$$STBE(I,K) = \sum_H TEMP(H,I,J) * GSAL(I,K)$$
  

$$STBE(I,K) = \sum_H TEMP(H,I,J) * OSAL(I,K)$$
  
  

$$\sum_I STBE(I,K) \text{ STUDENT EDUCATIONAL BENEFITS}$$
  

$$I \text{ (by socio-economic strata)}$$
  
  

$$\sum_{IK} STBE(I,K) / \sum_{IK} STBE(I,K) \text{ PERCENTAGE OF STUDENT BENEFITS}$$
  

$$I \text{ IK (received by students belonging into appropriate socio-economic strata)}$$

### C.7 Input Variables

BUSI(I,K) REST OF THE ECONOMY ALLOCATIONS DISTRIBUTION  
 FCOR(I,K) FEDERAL CORPORATION TAX DISTRIBUTION  
 FEDR(I,K) PERCENTAGE OF THE FEDERAL TAX FUND PAID BY EACH SOCIO-ECONOMIC STRATA  
 FPOR(I) PERCENTAGE OF OPERATING GRANTS PAID BY THE FEDERAL GOVERNMENT  
 FSAL(I,K) FEDERAL SALES TAX DISTRIBUTION  
 GRDS(I,K) GRADUATE STUDENTS SOCIO-ECONOMIC DISTRIBUTION  
 GSAL(I,K) GRADUATE STUDENTS LOAN EXPENDITURES DISTRIBUTION (into socio-economic strata)  
 GSAP(I,K) GRADUATE STUDENTS GRANTS DISTRIBUTION  
 MUNC(I,K) PROVINCIAL PROPERTY TAX DISTRIBUTION  
 OSAL(I,K) U.G. STUDENTS OSAP LOAN EXPENDITURES DISTRIBUTION  
 OSAP(I,K) U.G. STUDENTS OSAP GRANTS DISTRIBUTION  
 PCOR(I,K) PROVINCIAL CORPORATION TAX DISTRIBUTION  
 PRIV(I,K) U.G. STUDENTS SOCIO-ECONOMIC DISTRIBUTION  
 PROV(I,K) PERCENTAGE OF THE PROVINCIAL TAX FUND PAID BY EACH SOCIO-ECONOMIC STRATA  
 PPOR(I) PERCENTAGE OF OPERATING GRANTS PAID BY THE PROVINCIAL GOVERNMENT  
 PSAL(I,K) PROVINCIAL CORPORATION TAX DISTRIBUTION  
 TEMP(H,I,J) TEMPORARY COST MATRIX  
 (Allocation of CATES into I & J)  
 See section B.2 p.B-37

## VALUES OF SOCIO-ECONOMIC DISTRIBUTION VARIABLES

TABLE C-1

COL.	VARIABLE	PROGRAM (I)	SOCIO-ECONOMIC STRATA					SOURCE	
			under 2,999	3,000- 4,999	5,000- 6,999	7,000- 9,999	10,000 and up	TABLE	PAGE
1	2	3	4	5	6	7	8	9	10
1	BUSI(1,k)		.05	.08	.10	.25	.52	C-11	C-19
2	FCOR(1,k)		.101	.171	.191	.167	.370	C-7/15	C-13
3	FEDR(1,k)		.0698	.1856	.2732	.2317	.2394	C-9	C-15
4	FSAL(1,k)		.096	.237	.297	.241	.129	C-7/16	C-13
5	GRDS(1,k)		.127	.168	.171	.211	.323	C-13	C-22
6	GSAL(1,k) GSAP(1,k)		.127	.168	.171	.211	.323		
7	MUNC(1,k)		.152	.232	.255	.189	.171	C-7/9	C-13
8	OSAL(I,k)	Law	.060	.064	.155	.232	.50	C-13	C-22
9		Med.	.078	.091	.151	.248	.433		
10		Dent.	.087	.087	.206	.273	.347		
11		Other	.23	.1326	.2361	.3294	.0718		
12		CAATS	.2837	.2351	.1414	.2660	.0739		
13		Teach C.	.2447	.2414	.2543	.1860	.0735		
14	OSAP(I,k)	Law	.060	.064	.155	.232	.50		
15		Med.	.078	.091	.151	.248	.433		
16		Dent.	.087	.087	.206	.273	.347		
17		Other	.3719	.1924	.2259	.1867	.0230		
18		CAATS	.2786	.1692	.3779	.1390	.0350		
19		Teach C.	.2564	.3214	.2222	.1356	.0645		
20	PCOR(1,k)		.101	.170	.189	.166	.375	C-7/2	C-13
21	PRIV(I,k)	Art & Sc	.058	.09	.187	.266	.40	C-10/1	C-16
22		Eng.	.102	.139	.207	.264	.289	C-10/2	
23		Law	.06	.064	.155	.222	.50	C-10/3	
24		Med.	.078	.091	.151	.248	.433	C-10/4	
25		Dent.	.088	.088	.207	.271	.346	C-10/5	
26		Pharm.	.091	.172	.248	.306	.183	C-10/6	
27		Nursing	.036	.117	.217	.293	.337	C-10/9	
28		Teach C.	.099	.133	.243	.270	.255	C-10/10	
29		Other	.067	.108	.316	.276	.232	C-10/11	
30	PROV(1,k)		.102	.199	.256	.207	.236	C-9	C-15
31	PSAL(1,k)		.095	.236	.286	.245	.137	C-7/3	C-13

FEDERAL-PROVINCE TAX PORTIONS

TABLE C-

COL.	VARIABLE		CATE (H, 1,	VALUE	SOURCE
		H	NAME		
1	2	3	4	5	6
1	FPOR(H,1)	36	Loss of Corporation Tax	.900	TABLE C-18 page C-27
2		21	Refund of Sales Tax	.670	
3		37	Loss of Property Tax	.000	
4		32 34	Personal Income	.720	
5	PPOR(H,1)	36	Loss of Corporation Tax	.100	
6		21	Refund of Sales Tax	.330	
7		37	Loss of Property Tax	1.000	
8		32 34	Personal Income	.280	

C.8 Notes

This subsection gives the detailed assumptions underlying the cost and benefit calculations. It has been divided into four parts; first, the choosing of income class levels; second, the development of a general revenue base and tax incidence rates; third the determination of the socioeconomic composition of post-secondary institutions and fourth, the assumptions involved in breaking out each category of the trial balance sheet.

C.8.1 Definition of Class

In the main body of the report the reasons for choosing the income variable as a basis for division into class was given. This section details the selection of the exact class groupings used. These groupings were determined by the format of the existing data. The income groupings used are as follows:

## Student's Parent's Income

Under		\$2,999
\$3,000	-	\$4,999
\$5,000	-	\$6,999
\$7,000	-	\$9,999
\$10,000 +		

(See also TABLE A-8,p.A-20)

The groupings represent a common base derived from the studies listed below. In some cases a linear interpolation was used where the income classes employed in the study were not fine enough. This situation occurred when using the DBS study of University Income and Expenditure 1961 (F-20) (see TABLE C-3) where the \$5,000-\$5,999, \$6,000-\$7,999, and \$8,000-\$9,999 categories had to be broken down into the common distributions.

INCOME LEVEL STUDENT'S PARENTS  
AND CANADIAN TAXPAYERS DISTRIBUTION

TABLE C-3

Program	Median	Per cent						
		Under 2,999	3,000 4,999	5,000 5,999	6,000 7,999	8,000 9,999	10,000 14,999	15,000 Over
Arts & Science	6,448	10.5	21.0	14.1	17.9	11.3	13.6	11.6
Education	4,747	21.6	32.5	13.3	13.6	9.4	6.5	3.1
Engineering	5,379	16.1	28.2	15.0	14.6	10.2	10.9	5.0
Law	7,151	11.8	15.9	13.1	14.8	10.7	14.7	19.0
Medicine	6,439	14.0	21.1	11.2	14.7	11.9	12.8	14.3
Dentistry	5,905	15.0	19.6	17.0	15.1	12.1	14.3	6.9
Pharmacy	5,217	13.4	33.0	16.5	17.4	10.3	5.6	3.8
Classical Colleges	5,533	15.7	26.5	14.6	14.3	8.5	9.5	10.9
Canadian Taxpayers	-	36.5	41.7	9.4	7.1	2.3	1.8	1.2

Source: F-20 University Income and Expenditure 1961, Table 18,  
P-25, Cat. No. 81-520, DBS, 1963.

Median income figures were given in this study which suggested, when plotted, that a linear interpolation was not unrealistic. No attempt to fit a curve to the data was made. The DBS study Post-Secondary Student Population Survey (F-21). (see TABLE C-4) which formed the basis for the socio-economic distributions has income categories in thousand dollar intervals and hence provided no difficulty.

COMBINED PARENTAL INCOME IN  
RELATION TO CHOICE OF PROGRAM

TABLE C-4

STUDY PROGRAM	NR	\$1 -1100	1101 -2000	2001 -3000	3001 -4000	4001 -5000	5001 -6000	6001 -7000	7001 -8000	8001 -9000	9001 -10000	10001 -11000	11001 -15000	OVER 15000	TOTAL
<u>ONTARIO</u>															
UNIV GRAD	4020	245	406	471	735	754	697	817	519	245	1099	102	1424	1335	12868
UNIV U-GRAD	13503	1117	1533	1866	3050	3748	6300	7244	6640	5628	6878	3888	11012	13508	85915
NURSING	1716		57	194	257	566	581	943	762	470	833	476	1195	695	8746
TEACHER TR	1355	203	276	305	587	466	836	1095	575	789	784	195	1187	642	9296
OTHER	5013	237	380	527	400	1434	2113	3237	1802	984	1881	637	2423	866	21934
TOTAL	25608	1802	2652	3364	5030	6968	10527	13336	10298	8115	11475	5298	17240	17046	138758

Source: F-21 Post-Secondary Student Population Survey, 1968-69,  
Table 20, P-110, Combined Parental Income in  
Relation to Choice of Study, Cat. No. 81-543, DBS,

The choice of income classes which were finally used was determined in the main by the classifications used in James Johnson's study The Incidence of Government Revenues and Expenditures (F-33) prepared for the Ontario Committee on Taxation employing 1961 data. (see TABLE C-5). The income divisions in this study have been reduced from seven to five by simple aggregations. The main limitation here is the low upper bound of \$10,000. Clearly in 1970 a figure closer to \$15,000 would be more appropriate.

C.8.2 The General Revenue Base and  
Tax Incidence Rates

It is assumed that revenues to support both the operating and capital expenditures of post-secondary education are taken from a general revenue fund as opposed to being supported by a specific tax. The general revenue fund consists of all revenues which are collected by the government where a reasonably clear indication that the revenues are meant to be spent in a specific manner is not apparent. To give an example, it is assumed that hospital premium contributions are not part of the general revenue fund because the money is raised specifically for medical services. Other categories,

## DISTRIBUTION OF REVENUES IN CANADA, 1961

TABLE C-5

	Family money income class						Distri- bution to Ontario residents
	Under \$2,000	\$2,000- 2,999	\$3,000- 3,999	\$4,000- 4,999	\$5,000- 6,999	\$7,000- 9,999	\$10,000 and over
(thousands of dollars)							
<b>Provincial Revenues (Ontario)</b>							
Personal income tax.....1	603	1,086	4,705	10,979	35,834	33,421	34,072
Corporation income tax.....2	2,704	3,070	4,069	5,887	11,244	9,655	19,571
General sales tax.....3	5,321	6,844	12,014	18,227	36,643	31,387	17,464
Highway-user revenues.....4	3,009	5,449	10,356	23,706	45,873	38,199	20,208
Excise taxes.....5	3,134	2,644	7,275	12,310	25,422	21,979	10,236
Succession duties.....6	—	—	—	—	—	—	89,000
Natural-resource revenue.....7	903	865	1,199	1,658	3,404	3,231	5,740
Social insurance contributions (includes \$9 million munic.).....8	1,584	3,000	5,556	10,488	22,956	18,660	9,576
Hospital premiums.....9	11,547	8,324	9,756	14,232	24,884	14,948	5,809
Other taxes and miscellaneous revenue10	2,400	2,123	2,930	4,435	8,283	6,287	6,042
Total.....11	31,205	33,405	57,860	101,922	214,543	177,767	167,898
<b>Municipal Revenues</b>							
Property tax.....12	38,745	29,816	40,157	61,245	110,505	80,438	64,094
Business tax.....13	1,700	1,778	2,553	3,903	7,575	6,119	7,472
Miscellaneous revenue.....14	3,920	3,201	4,052	6,191	10,861	7,707	6,768
Total.....15	44,365	34,795	46,762	71,339	128,941	94,264	78,334
<b>Total Provincial and Municipal Revenue..16</b>	<b>75,570</b>	<b>68,200</b>	<b>104,622</b>	<b>173,261</b>	<b>343,484</b>	<b>272,031</b>	<b>246,232</b>
<b>Federal Revenues</b>							
Personal income tax.....17	4,237	7,627	33,048	77,114	251,678	234,730	238,966
Corporation income tax.....18	17,475	20,204	26,305	37,515	71,334	62,230	138,237
General sales tax.....19	15,533	18,324	30,639	52,914	104,534	84,792	45,264
Other excises.....20	9,529	9,749	17,984	29,238	57,935	39,232	17,733
Estate tax.....21	—	—	—	—	—	—	34,500
Social insurance contributions.....22	6,985	14,307	27,104	44,534	39,172	20,286	10,612
Import duties.....23	11,166	10,806	16,749	26,835	52,769	40,523	21,252
Miscellaneous revenue.....24	2,986	2,807	3,363	5,046	8,891	6,612	8,395
Total.....25	67,911	83,824	155,192	273,196	586,313	488,405	514,959
<b>Other Provincial and Municipal Revenue</b>							
Corporation income tax.....26	2,557	3,038	3,852	5,379	10,162	9,078	22,834
Highway-user revenues.....27	2,892	2,872	4,481	7,257	14,352	10,982	5,764
Property tax.....28	4,858	5,125	7,222	10,893	21,022	17,137	23,843
Natural resources.....29	2,957	3,487	4,424	6,154	11,668	10,502	26,408
Other taxes and miscellaneous revenue30	649	963	1,286	1,700	3,424	3,312	9,766
Total.....31	13,913	15,485	21,265	31,383	60,628	51,011	88,615
<b>Total Revenue for All Levels of Government</b>	<b>157,394</b>	<b>167,509</b>	<b>281,079</b>	<b>477,840</b>	<b>990,425</b>	<b>811,447</b>	<b>849,806</b>

Source: F-33 Johnson, J.A., The Incidence of Government Revenues and Expenditures, A Study Prepared for the Ontario Committee on Taxation, Table 3:3 - P-36, Distribution Revenues in Canada 1961, Queen's Printer, Ottawa.

such as personal income tax, or corporation tax, are not specifically intended for one purpose and therefore are included in the general revenue fund. It should be noted that a distinction is being made throughout between federal revenues and Ontario revenues.

The exact revenue categories that have been excluded are given below. The categories referred to are from the DBS Consolidated Government Finance, (F-17) (see TABLE C-6).

TABLE C-6 has been used to obtain the federal and the Ontario revenues. Unfortunately, only data for 1966 was available and not for the base year 68-69. In using the 1966 as a proxy for the 1968 year it is being assumed that the individual revenue categories have not changed relation to each other; that is that personal income tax contributions in 1968 form the same percentage of total revenue as they did in 1966. Absolute amounts are not important here. Because there has been no major alteration in tax schedules this assumption is not too unreasonable.

The line references below refer to the lines of TABLE C-6.

1. Line #3 Taxes on premiums of insurance companies.
2. Line #11 Motor fuel and fuel oil.
3. Line #20 Hospital insurance premiums.
4. Line #24 Motor vehicle licenses and permits.
5. Line #28 Sales and services.
6. Line #30 Interest discount premium and foreign exchange

Having obtained the tax categories and the relative share of each tax category in the general revenue fund the next problem was to calculate the contribution which each of the income classes, defined above, makes to the general revenue fund. This problem is dealt with in James Johnson's monograph (F-33).

Johnson estimates tax incidence rates for all the major tax categories. (see TABLE C-5). His study is based on the distribution of revenues in Canada and Ontario for 1961. This base year presents a significant obstacle to producing meaningful results for the year 1968-69. Some justification for using his data can be found in the relatively constant tax structure that has existed. In using this data it is being assumed that each income class is still paying the same relative percentage of the tax burden. Again, absolute amounts are not important in this analysis. It may be very doubtful whether anyone really knows the exact incidence of taxes. Even many of the assumptions Johnson makes for 1961 could be differed with. Unfortunately, his work and that of W. Gillespie, The Incidence of Taxes and Public Expenditures in the Canadian Economy (E-24) prepared for the Caster Commission, are the only good studies available. They have been used in default with the hope that further work will be done on the topic.

Johnson's tax categories are not exactly similar to those found in the DBS Consolidated Government Finance (F-17) statement referred to previously. They are readily mapped into these categories. TABLE C-7 gives the corresponding lines of TABLE C-6 (Consolidated Government Finance) and TABLE C-5 (Johnson's Study). For example, category 1 of TABLE C-6 is taxes on corporations which is broken out by line #18 of Johnson's TABLE C-5, the federal incidence of corporation tax, and lines #2 and 26 of Johnson's table giving the provincial incidence of corporation tax. The incidence rates TABLE C-8 are calculated as percentages of the revenues of TABLE C-5 distributed to Ontario residents by the different income classes.

After completing both of the above general operations, one has determined the percentage of general revenue paid by each income class to the federal and also to the provincial general revenue fund. (TABLE C-9). This incidence calculation is the basic distribution used in allocating the revenues spent on post-secondary education. As such it is the key to the cost analysis.

### C.8.3 Determination of the Composition of Post-Secondary Institutions

Certain problems arose in determining the socio-economic composition of post-secondary institutions owing to the lack of readily available data. Primary reliance was placed on the DBS Post-Secondary Student Population Survey, 1968-69 (F-21). From this survey the overall backgrounds

No.	Source	thousands of dollars			
		Ontario	Federal	Provincial-Municipal	Total
	<b>Taxes:</b>				
	Income:				
1	Corporations .....	250,340	1,742,725	564,508	2,307,233
2	Individuals .....	393,837	3,050,420	1,108,562	4,158,982
3	On premiums of insurance companies .....	23,505	—	54,280	54,280
4	Other, on corporations .....	654	—	20,919	20,919
5	Real property .....	872,905	—	2,022,772	2,022,772
6	Personal property .....	—	—	15,167	15,167
7	Business .....	83,943	—	152,064	152,064
8	Special assessments (owners' share) .....	25,660	—	119,058	119,058
9	Poll .....	37	—	4,728	4,728
			203,621	—	203,621
	<b>Sales:</b>				
10	General .....	391,575	2,073,081	1,009,642	3,082,723
11	Motor fuel and fuel oil .....	286,787	—	743,603	743,603
12	Alcoholic beverages .....	—	—	735	735
13	Amusements and admissions .....	23,466	—	45,734	45,734
14	Tobacco .....	19,113	—	74,646	74,646
15	Other commodities and services .....	—	—	41,492	41,492
16	<b>Total sales taxes .....</b>	<b>720,941</b>	<b>2,073,081</b>	<b>1,915,852</b>	<b>3,988,933</b>
17	Excise duties and special excise taxes .....	—	774,578	—	774,578
18	Customs import duties .....	—	777,586	—	777,586
19	Succession duties .....	57,913	101,106	117,580	218,686
20	Hospital insurance premiums .....	157,333	—	188,831	188,831
21	Other taxes .....	12,877	170	34,083	34,253
22	<b>Total taxes .....</b>	<b>2,599,945</b>	<b>8,723,287</b>	<b>6,318,404</b>	<b>15,041,691</b>
	<b>Privileges, licences and permits:</b>				
23	Liquor control and regulation .....	30,306	—	63,445	63,445
24	Motor vehicles .....	104,531	—	253,889	253,889
25	Natural resources .....	41,531	7,813	514,131	521,944
26	Other .....	26,983	31,206	99,200	130,406
27	<b>Total privileges, licences and permits .....</b>	<b>203,351</b>	<b>39,019</b>	<b>930,665</b>	<b>969,684</b>
28	Sales and services .....	51,252	120,989	161,118	282,107
29	Fines and penalties .....	20,790	3,483	49,967	53,450
30	Interest, discount, premium and foreign exchange ..	87,016	350,560	208,173	558,733
	<b>Contributions from enterprises:</b>				
31	Liquor boards and commissions .....	104,520	—	327,061	327,061
32	Other enterprise remittances .....	2,113	163,670	61,317	224,987
33	<b>Total contributions from enterprises .....</b>	<b>106,633</b>	<b>163,670</b>	<b>388,378</b>	<b>552,048</b>
34	Other revenue .....	26,591	—	—	26,591
35	<b>Gross revenue from own sources .....</b>	<b>3,095,578</b>	<b>9,722,798</b>	<b>8,144,069</b>	<b>17,866,867</b>
36	Federal enterprises — In lieu of taxes .....	4,431	—	7,349	7,349
37	Provincial enterprises — In lieu of taxes .....	6,678	—	16,389	16,389
38	<b>Sub-totals .....</b>	<b>3,106,687</b>			
	<b>Deduct:</b>				
39	Revenue derived from expenditure functions .....	8,455	—	—	8,455
40	Interest revenue (contra debt charges) .....	73,973	—	—	73,973
41	<b>Sub-totals .....</b>	<b>3,024,259</b>	<b>9,722,798</b>	<b>8,167,807</b>	<b>17,890,605</b>
	<b>Transfers from the federal government:</b>				
42	Grants-in-aid and shared-cost contributions .....	391,889	7,469	26,155	33,624
43	Unconditional transfers .....	43,225	289,922	174,926	464,848
44	<b>Totals .....</b>	<b>3,459,373</b>	<b>9,425,407</b>	<b>7,966,726</b>	
45	<b>Total consolidated .....</b>				<b>17,392,133</b>

Source : F-17 Consolidated Government Finance, 1966 - Table 1, p. 8.  
 Table 6, p. 12, 13, Consolidated Provincial-Municipal Revenue, Cat. No. 68-202, DBS, 1969.

## JOHNSON'S TAX INCIDENCE AND GOVERNMENT REVENUE CATEGORIES

TABLE C-7

TABLE C-6 (F-17 Consolid.Fin. ) line no.	TABLE C-5 (F-33 Johnson's Study)	
	Federal Revenues line no.	Provincial Revenues line no.
1	18	2
2	17	1
4	--	26
5	--	12 + 28
6	--	12 + 28
7	--	13
8	--	16 + 31
9	--	16 + 31
10	19	3
12	--	16 + 31
13	--	16 + 31
14	--	16 + 31
15	--	16 + 31
16	--	--
17	20	5
18	23	--
19	21	6
21	25	16 + 31
22	--	--
23	25	16 + 31
25	25	7 + 29
26	25	16 + 31
27	--	--
28	--	--
29	25	16 + 31
30	--	--
31	--	16 + 31
32	25	16 + 31
33	--	--
34	--	--
35	25	16 + 31
36	24	--

of all students in teachers' colleges, nursing schools, university undergraduates, university graduate students and community colleges were determined. (see TABLE C-4) It was assumed that the other category in TABLE C-4 was composed essentially of community college students. This distribution in any event was used for the CAAT's. TABLE C-4 gives the DBS (F-21) from which the calculations were made. TABLE C-10 gives the actual percentage distribution used in the study. It will be noted that

SOCIO-ECONOMIC DISTRIBUTION

(Tax Incidence Rates)

TABLE C-8

	TABLE C-5	Parent's Income Classes				
	line No.)	Under 2,999	3,000- 4,999	5,000- 6,999	7,000- 9,999	10,000 +
1	1)	.014	.130	.297	.277	.282
2	2,26)	.101	.170	.189	.166	.375
3	3)	.095	.236	.286	.245	.137
4	5)	.070	.236	.306	.265	.123
5	6)					1.000
6	7,29)	.010	.163	.182	.166	.389
7	10,30)	.133	.193	.218	.179	.295
8	11)	.082	.204	.273	.227	.214
9	12,28)	.152	.232	.255	.189	.171
10	13)	.112	.208	.244	.197	.240
11	14)	.167	.240	.254	.180	.159
12	15)	.159	.237	.259	.189	.157
13	16,31)	.112	.211	.258	.206	.214
14	17)	.014	.130	.297	.277	.282
15	18)	.101	.171	.191	.167	.370
16	19)	.096	.237	.297	.241	.129
17	20)	.106	.260	.319	.216	.098
18	21)					1.00
19	22)	.131	.439	.240	.124	.065
20	23)	.122	.242	.293	.225	.118
21	24)	.152	.221	.233	.174	.220
22	25)	.070	.197	.270	.225	.237

PERCENTAGES OF THE FEDERAL AND PROVINCIAL TAXES

(paid by each socio-econ. strata)

FEDR(1,K)  
PROV(1,K)

TABLE C-9

TAX REVENUE FUND	UNDER 2,999	3000-4999	5000-6999	7000-9999	10,000 +
FEDERAL	.0698	.1856	.2732	.2317	.2394
PROVINCIAL	.102	.199	.256	.207	.236

Source: TABLES C-8, C-5

non-responses were not included in the tabulations. The DBS table may be slightly misleading in that the values in each of the cells of the table represent not the number of people sampled but that absolute number of the whole student population. Only 4,000 (see page 142 of DBS) students were questionnaired which is 3.2 per cent of the total post-secondary population.

As mentioned previously, only the income variable was used as the criteria for grouping although information was available on parents' education and occupational levels. Difficulties in acquiring the master tape from DBS prevented optimal use of the data. Similarly any hope of providing institutional specific distributions had to be abandoned.

While the DBS study (F-21) had collected detailed information on study programs, this information has as yet not been published. Nevertheless, it was the desire in this study to take into account some of the variations among different programs at the university level. The only information readily available concerning programs was from the 1961 DBS study of University Income and Expenditure (F-20) which gave the income level of the students' parents for eight selected courses. There are two drawbacks to using these figures aside from 1961 base year. Primarily the figures are for Canada as a whole; no Ontario breakdowns are available. Secondly, not all the

PRIV (I,K)

U.G. STUDENTS'S PARENTS SOCIO-ECONOMIC DISTRIBUTION

TABLE C-1

Program		Under 2,999	3,000 4,999	5,000 6,999	7,000 9,999	10,000 Over
1	Arts & Science	5.8	9.0	18.7	26.6	40.0
2	Engineering	10.2	13.9	20.7	26.4	28.9
3	Law	6.0	6.4	15.5	22.2	50.0
4	Medicine	7.8	9.1	15.1	24.8	43.3
5	Dentistry	8.8.	8.8	20.7	27.1	34.6
6	Pharmacy	9.1	17.2	24.8	30.6	18.3
7	University Grad's	12.7	16.8	17.1	21.1	32.3
8	University U.G.'s	6.3	9.4	18.7	26.4	39.2
9	Nursing Schools	3.6	11.7	21.7	29.3	33.7
10	Teachers Colleges	9.9	13.3	24.3	27.0	25.5
11	Other	6.7	10.8	31.6	27.6	23.2
12	TOTAL	6.9	10.6	21.1	26.4	25.0

Source: TABLE C-4

programs that are listed are applicable to the Ontario case. The education, and classical college courses have been dropped.

The procedure employed to integrate the program breakdowns was as follows: It was assumed that there was no change in the relative composition of one program to another from 1961 to 1968. The relative percentages were calculated employing 1968-69 enrolment figures rather than 1961 enrolments to catch any general shift from one program to another. Some alteration in the income groupings which has been described previously, was also necessary before the calculations were made. These relative percentages of the programs to each other were then applied to the university undergraduate distribution obtained from the Post-Secondary Student Population Survey (F-21). This meant that the overall distribution of the university undergraduates if one summed over all courses would be the same as that of the student population survey. At the same time each of six different program distributions were generated. These figures are also given in TABLE C-10. It is hoped that in the second phase of the project, significant improvement will be made in the socio-economic figures. The distributions calculated in this section form the key part of the benefit calculations.

#### C.8.4 Trial Balance Calculations

As was outlined in the main body of the report, the actual distribution of costs and benefits are made from the Trial Balance sheet (see B.1, p. B-1). This section outlines explicitly how each category is distributed. The sum of all the distributions from each category forms the total cost and total benefit calculation. The categories of the trial balance are taken line by line except where easy aggregations can be made.

#### CATE (1) & (2) - Government Operating Grants.

This category has been explained earlier although there are some refinements which must be made at this time. The government operating grants come from either the provincial or federal general revenue funds. Considering the universities only, the proportional breakdown used is that the federal government contributes one-half of the total eligible operating costs, and the provinces contribute the other half minus the amount collected in tuition fees. This represents in actuality the federal government contributing, in grant form, about 60 percent of the operating revenue, and the province making up the other 40 percent. This proposition

has been assumed to be constant throughout the university system. For all other post-secondary institutions it is assumed that the province grants the whole operating cost less the tuition fees.

Depending, therefore, on the breakdown between the government level, either the provincial tax incidence rate for tax contributions to general revenue or the federal tax incidence rate is applied to the operating grants to break out the 'cost' to each income group. The operating grants are part of the cost of subsidizing Post-Secondary Education. Because the grants are a subsidy they have been classified as a benefit to the student and hence, to the student's parents' income group. Two steps are involved in distributing this benefit. First, the operating grants are broken out into programs by the formula weights. Second, the socio-economic distribution of each program is applied to the result of step one. The end result gives the benefit by income classes.

CATE (22) is the opportunity cost of the expenditure made on the operation of post-secondary institutions. All opportunity costs are handled in the same manner except where noted. The usual procedure is to consider them in exactly the same manner as the out-of-pocket costs of the first section of the trial balance.

CATE (2) - Gifts for Operating Purposes. This category is very similar to the previous category with the one major exception that the funds referred to here are not coming from the government but rather from the private sector. As a benefit to the student they are handled in an exactly analogous manner to the government operating grants.

The cost to the public is different than the government grants as the incidence among the various income levels varies between private and public sources. There has been virtually no research done on who really bears the burden of gifts. As the sums involved are not unusually high a guess estimate has been made. Intuitively it seemed reasonable that the gifts originate in the main from the upper income classifications. It will be assumed that one-half of the gift is borne directly by the two highest income classes with the highest class responsible for two-thirds of this amount. The remaining fifty percent is assumed to be passed on. The incidence rate of the corporation tax has arbitrarily been chosen to distribute this remaining amount. The final distribution is presented in TABLE C-11. This distribution will be used in all cases involving private contributions to the university.

BUSI(1,K)

REST OF ECONOMY DISTRIBUTION

TABLE C-11

Under 2999	3000- 4999	5000- 6999	7000- 9999	10000 +
.05	.08	.10	.25	.52

CATE (3) & (30) - Student's Tuition Fees.

Fees paid to post-secondary institutions are considered as a direct cost to the student or student's parents. They are distributed according to the tuition level of the program in which the student is enrolled. Benefits from this expenditure are dealt with elsewhere. The opportunity cost is handled in a manner similar to the category above.

CATE (4) & (31) - Student Academic Equipment.

This category is similar to the one above in that it is a direct cost to the student. The equipment costs vary by program and are broken out by program. Estimates of the actual amount spent are found in the DBS Post-Secondary Population Survey (F-21). The opportunity costs associated with this category have been handled in a standard manner.

CATE (5) - Ontario Student Awards, Grant Portion.

The student financial assistance programs present some difficulty in determining exactly who is the recipient of aid. As far as the funding or cost aspect is concerned this can be handled in a relatively straight forward manner. All OSAP grant money originates out of the provincial general revenues fund, hence the incidence on each income class is easily calculated.

Substantially more work was involved in determining who benefits. The size and qualification for awards depend on not only the socio-economic background but also the dependent or independent status of the applicant. In the professional faculties, such as law, medicine, and to a limited extent dentistry, this is a very important consideration. Therefore a program breakdown for the universities seemed imperative as well as separate distributions for each of the other main types of institutions.

Unpublished information from the Department of University Affairs (F-9) aided the estimation of benefit distributions. Detailed information by institution type and parental income class was available on both grants and loans. These data are listed in TABLE C-12.

### STUDENT AWARDS

(numbers and average amounts by parent's income)

TABLE C-12

PARENT'S INCOME	UNIVERSITIES		CAAT's		TEACHERS COLLEGES	
	NUMBER	AMOUNT	NUMBER	AMOUNT	NUMBER	AMOUNT
Under 3000	5300	1354	244	1525	325	936
3000 - 3999	1429	1321	63	1458	114	1423
4000 - 4999	1763	1238	55	1476	152	861
5000 - 5999	2518	1117	32	1473	206	787
6000 - 5999	3256	998	32	1487	207	708
7000 - 7999	3434	870	20	2247	184	545
8000 - 8999	3263	751	10	5582	155	484
9000 - 9999	2661	638	424	485	83	464
10000 - 10999	1947	572	263	670	42	422
11000 - 11999	1229	501	121	437	18	575
12000 - 12999	736	494	57	631	8	765
13000 - 13999	380	491	36	618	6	521
14000 - 14999	209	591	32	724	5	620
15000 - 15999	157	566	11	877	6	933
16000 - 16999	169	651	12	863	3	1080
17000 - 17999	56	834	10	367	2	840
18000 - 18999	41	848	8	822	2	910
19000 - 19999	20	1012	4	715	25	910
2000 & over	337	1064	97	358	1568	770

Source: F-9      No. of Awards and Average Award by Amount and Parents Incomes, Universities, CAATS, Teachers Colleges, Summary, DUA, 1970  
(unpublished printouts)

The method of computation for all institutions except the the universities is as follows. The first difficulty to overcome was the fact that loans and grants were combined in the tables. Rather than separating the loan and grant portions for each average award in the interval

provided, the overall average award figure for each income group was split into loan and grant portions. Once the loan and grant portions were calculated, the figures were multiplied by the total number of awards in each income group. In this manner an overall distribution of OSAP loans and grants by income level was created. The distributions are given in TABLE C-13.

The universities presented more of a problem owing to the variations in programs. The Department of University Affairs could not supply the number of awards given by program at this time. They were, however, able to supply the number of applications received in a selected number of programs. (See TABLE C-14) From the Minister's Report, 1968 (F-8) the total number of awards given in the time period was ascertained.

O.S.A.P. - SUMMARY

TABLE C-14

	No. of Applications	Estimate No of Awards
Arts	19,942	18,719
Science	6,105	5,459
Engineering	3,475	3,107
Education	992	N/A
Commerce	1,599	1,430
Medicine	1,359	1,215
Dentistry	472	528
Law	1,558	1,393
Other	2,513	2,247
Graduate	1,901	N/A
	39,916	34,098

Source: F-9

# LOANS AND GRANTS DISTRIBUTION

GSAL(I,K)  
GSAP(I,K)  
OSAL(I,K)  
OSAP(I,K)

TABLE C-13

PROGRAM	Under \$2,999	\$3,000 - 4,999	\$5,000 - 6,999	\$7,000 - 9,999	\$10,000 +
CAAT					
Loan	.2837	.2351	.1413	.2660	.0739
Grant	.2786	.1692	.3779	.1390	.0350
TEACHERS COLLEGE					
Loan	.2447	.2414	.2542	.1860	.0735
Grant	.2564	.3214	.2222	.1356	.0645
UNIVERSITY					
Law (Loan and Grant)	.060	.064	.155	.222	.500
Medicine (Loan and Grant)	.078	.091	.151	.248	.433
Dentistry (Loan and Grant)	.087	.087	.206	.273	.347
Grads (Loan and Grant)	.127	.168	.171	.211	.323
OTHER					
Loan	.2300	.1326	.2361	.3294	.0718
Grant	.3719	.1924	.2259	.1867	.0230

source: TABLE C-12

As the difference between the columns of TABLE C-14 was not extremely large it was decided to use the applications as a proxy for the distribution of awards among programs. Reducing the number of applications by the difference between the applications and the actual number of awards gave an absolute number of awards in the various programs (See TABLE C-14). It was assumed that the probability of being rejected was the same in each program. The next step was to separate out the awards given to medicine, law and the last year of dentistry from the other programs. Because these faculties have many students who are classed as independent under the OSAP criteria the awards to them are not related to parental income, and have a tendency to be larger than the awards given in the cases where a parental contribution is required. The average award in the above professional faculties was assumed to be \$1,354 as compared to \$953 overall. The awards, it was believed, could be distributed by the socio-economic composition of the faculty. The distribution of all university programs is given in TABLE C-13.

The calculation of the distribution of awards in the programs other than the three faculties mentioned above was similar to that for community colleges and teachers college with one exception. Before calculating the distributions from TABLE C-12, the awards given in law, medicine, and the final year of dentistry were subtracted from the total for each income grouping. The final result is shown in TABLE C-13. It may be noted that the dentistry distribution is a combination of awards given on the basis of the overall socio-economic composition of the program. All awards to graduate students are assumed to be according to the overall socio-economic composition.

As each university does not have a full range of professional faculties, the actual allocation of award money in the institution to the various programs was made on the basis of enrolments and the two average award sizes.

Given the above distribution it is an easy task to break out the benefits by income class. All grants to students are considered subsidies or benefits.

### CATE(6) & (27) Ontario Student Award, Loan Portion

Many of the assumptions underlying the distribution to break out OSAP loans have already been explained under OSAP grants. There are, however, a number of differences. Only the amount of subsidy in the form of foregone interest and the associated opportunity cost are assigned as a cost or benefit for the actual loan itself is assumed to be repaid later.

The other modification from the OSAP grant is that the funding resides with the federal rather than provincial government. Therefore, any costs associated with the program are distributed by the federal tax incidence rates.

### CATE(7) Ontario Graduate Fellowships

Conceptually the graduate fellowships are similar to the OSAP grants, the main difference being that they are received by a much more limited number of students in a limited number of programs. As the graduate fellowships do not involve a means test they are broken out by the overall socio-economic composition of the programs involved.

It was assumed that only students enrolled in ten of the graduate programs could qualify for a fellowship. These programs are listed in TABLE C-15.

#### PROGRAMS ELIGIBLE FOR O.G.F.

TABLE C-15

Psychology
Social Sciences
Geography
Humanities
Fine Arts
Law (Graduate School)
Music
Physical Education
Mathematics
Physical and Biological Science

The programs can be divided into purely science orientated programs and arts and humanities. The reason for this division is that the Minister's Report (F-8) gives the value of awards broken down in this fashion. It has been assumed that all winter awards are \$1,500 and summer awards \$750. For convenience, that data input has also included an institution break down which, though unnecessary for Phase 1, would save work in Phase 2. Given absolute dollar values of the graduate fellowships in each program, it is possible to calculate the benefit to each income group by using the general socio-economic composition of graduates.

As Ontario Graduate Fellowships are funded by the Ontario government the provincial tax incidence rates are used to allocate costs.

Insufficient data was available on non-government fellowships to allow any meaningful analysis of the costs and benefits of this form of student aid. Similarly, Canada Council Fellowships have not been included. In Phase 2 this situation could hopefully be altered.

CATE(8) & (10) & (28) - Gifts for Student Financial Aid; Direct Student Awards

Relatively little information is available on both who receives and who gives this aid. It has been assumed that the aid is given independent of family background and comes from the same source as described under Gifts for Operating Purposes. Thus, the business community bears the cost and the overall socio-economic composition distributes the benefits.

CATE(9) & (11) Institutional Student Awards: Institutional Net Expenditures

This category has been omitted as the revenues involved have been allocated elsewhere since the revenue source is the institution itself. The analysis here has been carried out solely on institutional receipts.

CATE(12) & (23) Government Capital Grants

Capital allocations posed a significant problem in the analysis. Logically it may be argued that while

attending an institution one should be assessed part of the depreciation or renewal costs for the time period in attendance as well as some construction costs. This type of calculation is extremely difficult. There is some cost involved, however, and a simplifying assumption has been made to view the capital allocations for 1968-69 as a proxy variable for this cost. Therefore, the capital grants are distributed as a subsidy or benefit to the student's parents and as a cost to society. Care has been taken to distribute the capital grants into programs by means of formula weights in order to minimize any distortion which would occur if one program were assigned the total expenditure.

A further simplification has been made in determining the source of capital grants. It has been assumed that they are solely provincially funded. Phase 2 will take into consideration the federal contribution to such building as the Health Science complexes. Standard procedures have been used to break out the costs and benefits by the overall distributions.

#### CATE(13) OUCAC Financing

This category is handled in exactly the same manner as capital grants with the exception that the funding is from the Ontario government in all cases.

#### CATE(14) & (15) Mortgage Financing, Other Financing

This category is analogous to the government capital grants with the exception that the source of funds is the private sector. Owing to the lack of knowledge on the incidence of funds raised in this category, a very tenuous assumption has been made to use the general business incidence distribution developed in the discussion of line #2.

#### CATE(16) Campaign and Capital Gifts

This category is handled in the same manner as the category 'Gifts for Operating Purposes' - CATE(2)

#### CATE(17) & (18) & (19) Depreciation, Repayment to OUCAC, Other Repayment.

These categories have all been omitted as they fall on the allocation rather than receipt side. In each

case the money has already been allocated both as a cost and as a benefit.

CATE(21) Refund of Sales Tax

The refund of the sales tax is handled in the same manner as any government subsidy. The analytical difference between this and other subsidies is the difference in provincial government. The figures used here are the general federal sales tax and the general provincial sales tax. About two-thirds of the revenue under this assumption is a federal government subsidy. (See TABLE C-16)

FPOR(H)

PPOR(H) FEDERAL & PROVINCIAL TAX SPLITS

TABLE C-16

	FED	PRO
Corporate	90	10
Sales	67	33
Property	0	100
Personal Income	72	28

Opportunity Costs

Many of the categories under opportunity costs have already been dealt with in the Out-of-Pocket Costs. The remaining categories are considered below.

CATE(24) Gifts (All)

The opportunity costs associated with gifts to post-secondary institutions are handled in one manner. They are considered an indirect benefit to the student and are broken out by the student's parents' income class distribution. As a cost, all gifts are allocated by means of the general business distribution.

CATE(25,29) Loss of Tax (Gifts), Loss of Tax (Awards)

Because of the general uncertainty concerning the source of gifts, the estimated loss of tax revenue in gifts is hazardous. The assumptions in estimating this have been made elsewhere. In this section it is of more concern to establish a reasonable division of the revenues between the federal and provincial governments. It has been decided that the best estimate may be made on the basis of the corporation tax. This estimate would give 90 percent of the revenues to the federal government and 10 percent to the provincial. (see TABLE C-16)

CATE(26) OSAP Grants and Fellowships

The calculation of the opportunity costs to government grants has been simplified slightly by aggregating the student grants from OSAP with the graduate fellowships. Both awards will be treated in a manner similar to the out-of-pocket costs of the OSAP grant category CATE(5). This assumption distorts the benefit calculations slightly by giving a greater subsidy to the student from a low income background. The magnitude of funds involved here does not make this a serious limitation. The cost calculations are unaffected by this aggregation.

CATE(22) & (34) Loss of Tax (Fees and Equipment)  
Loss of Tax (Earnings)

The loss of tax on personal expenditures for education are a cost to the government. There has been ascribed a benefit portion to these opportunity costs on the grounds that the government must make up the revenues in another manner. The benefits are broken down by the fees paid or by enrolment, in the case of loss of earnings. The cost to the government has been allocated to each governmental level by means of the personal income tax. A weighted average for five given income levels was used to ascertain the federal provincial split of the tax.

CATE(33) Loss of Student's Annual Earnings

Foregone earnings are the largest personal opportunity cost associated with education. The loss of earnings has been assumed constant for students of all backgrounds, and to vary only with the length of the program. The benefit calculations are the increased future income due to post-secondary education.

CATE(35) Institutional Employed Capital

This category assesses the opportunity cost associated with the investment tied up in all capital assets of a post-secondary institution. It may be considered as similar to a "shadow rent". To the extent the post-secondary institution does not have to pay this rent it represents a subsidy to the student. A similar argument applies also to the loss of corporation tax or property tax. As a cost it is assumed to be similar to the operating cost and will be broken back in the same manner as a cost to the public. The split between the federal and provincial government is assumed to be the same as that for the operating grants.

CATE(1) Incidence on each income group is determined in a straightforward manner.

CATE(36) Loss of Corporation Tax

The assumption implicit in this category is that the government would receive tax revenues if funds were invested in the private sector. Since the post-secondary schools do not pay corporate tax this is seen as a subsidy to the institutions. The distribution of the benefits is straightforward. The distribution of the costs is assumed to be that of the normal rates of the federal and provincial corporate tax. (see TABLE C-16)

CATE(37) Loss of Property Tax

The rationale for including the loss of property tax is the same as for the corporation tax. The only difference is the fact that the property tax is solely a municipal tax and therefore falls under the provincial government incidence rate. (See TABLE C-16)

The Tables C-1 and C-2 (pp. C-6,7) summarize the socio-economic distributions and federal/provincial breakouts used in this section of the study.

# APPENDIX D

## BENEFIT ANALYSIS MODEL

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D. BENEFIT ANALYSIS MODELD.1 Male (Female) Cost-Benefit Analysis

The model generates two tables, for MALES and FEMALES separately. Both tables are conceptually identical. Each of these tables has two sections called SOCIETAL and STUDENT. The procedure for computing the societal results is similar to that used for the computation of student results, except that:

- (a) no tax adjustment is applied to the calculation of lifetime earnings,
- (b) for the computation of Net Present Value, Benefit/Cost Ratio and Internal Rate of Return, societal costs are applied instead of student costs.

D.1.1 Definitions

Intermediate Results:

$Z_{jk}$  - EXPECTED EARNINGS  
at age (j) given that one graduated from  
program (k).

$$Z_{jk} = \sum_{m=1}^4 \sum_{j=1}^{48} Z_{ijm} P_{im:k}$$

$Z_{ijm}$  - LIFETIME EARNINGS  
represents the future expected gain in  
adjusted annual earnings due to PSE, by  
occupation (i), age (j) and level of  
education (m), in terms of earnings differ-  
entials between PSE and HS graduates.

$$Z_{ijm} = \left[ X_{ijm} [1-T(x)] L_{ij} \prod_{h=1}^{j-t+1} [1+G]_h M_{jN} [1+C_i] E_{ij} [1+\delta]^{C-O} \right] - \left[ X_j [1-T(x)] L_j \prod_{h=1}^{j-t+1} [1+G]_h M_{jN} [1+C] [1+\delta]^{C-O} \right]$$

$P_{im:k}$  - ENTR (I,L) PROBABILITY OF GOING INTO OCCUPATION  
(i), with educational level (m), given that  
one took program (k).

$$P_{im:k} = P_{m:k} * P_{i:mk}$$

$P_{m:k}$  - ATAN (L,I,M) PROBABILITY OF ATTAINING A  
LEVEL OF EDUCATION  
 (m) given the program (k),  $P_{m:k} = \prod_j \text{PASS}(I, j)$

$P_{i:m:k}$  - PROBABILITY OF ENTERING OCCUPATION  
 (i) 1 given the program (k) and level  
 of education (m). Set up at value of 1.

Output:

$NPV_K$  - NET PRESENT VALUE

This is the present value of a future stream of returns discounted by some factor which accounts for a time preference in which present assets are worth more than future assets.

Net present values are important in benefit/cost models of higher education in that higher education provides individuals and society with human capital whose value stretches into the future and is specified in terms of earnings differentials. In order to generate comparable statistics which reflect the differential returns from educational investment, the various income streams are computed in terms of net present value

$$NPV_k = \sum_{j=1}^{48} \frac{Z_{jk}}{(1+r)^{j-1}} - SC_k$$

$B/C_k$  - BENEFIT/COST RATIO

The benefit/cost ratio is a statistic used to measure the "profitability" of public investment projects. It is a single integer value which represents the ratio between the discounted stream of benefits, or returns, from an investment project and the discounted stream of costs which are attributed to these projects over some time period. Returns in the future, as well as costs, have less than full value in the present. In the benefit/cost model they are reduced to their present value by a discount rate which represents the social time-preference for future, as opposed to, present assets. The rate of interest on long term government bonds is normally used as a surrogate for the social discount rate.

$$B/C_k = \sum_{j=1}^{48} \frac{Z_{jk}}{(1+r)^{j-1}} / SC_k$$

R/R - INTERNAL RATE OF RETURN

It is that rate of discount ( $r^1$ ) which makes the present value of returns on a project equal to the cost of the project; alternatively it is the annual rate of profit expected from the project. It is also called marginal efficiency of capital and is a measure of the desirability of alternative investment in relation to the current rate of interest.

$$SC_k = \sum_{j=1}^{48} \frac{Z_{jk}}{(1-r^1)^{j-1}}$$

 $SC_k$  - TOTAL COST (SOCIETAL OR STUDENT)

is the sum of average costs per student, Academic Year & Program, over Academic Year - see p. B-38

(1) Societal Total Cost - see YEAS (I,J) P. B-38

$$SC_k = \sum_J YEAS(I,J) = \sum_J TSOC(I,J)/PROG(I,J)$$

(2) Student Total Cost

$$SC_k = \sum_J TSTC(I,J)/PROG(I,J)$$

D.1.2 Input Variables (Subscripts & Superscripts)

$C_i$	- SNOB (1)	- NON-PECUNIARY RATE OF RETURN (PSE GRAD.)
$C$	- HSCS (1)	- NON-PECUNIARY RATE OF RETURN (HS GRAD.)
$E_{ij}$	- EXIT (L,N)	NET MIGRATION
$G$	- GROW (R)	- ANNUAL RATE OF GROWTH
$L_{ij}$	- LABF (I,N)	LABOUR FORCE PSE PARTICIPATION RATE (F)
	- LABR (I,N)	LABOUR FORCE PSE PARTICIPATION RATE (M)
$L_j$	- HSPF (N)	- LABOUR FORCE HS PARTICIPATION RATE (F)
	- HSPM (N)	- LABOUR FORCE HS PARTICIPATION RATE (M)
$M_j$	- DIEF (N)	- MORTALITY RATE (FEMALES)
	- DIEM (N)	- MORTALITY RATE (MALES)
$N$	- HSAB (1)	- EARNING ABILITY INDEX OF HS GRADUATES
	- PSEC (1)	- EARNING ABILITY INDEX OF PSE GRADUATES
$X_{ijm}$	- EARN (I,N)	ANNUAL EARNINGS OF PSE GRADUATES (M)
	- GIRL (I,N)	ANNUAL EARNINGS OF PSE GRADUATES (F)
$X_j$	- HSEF (N)	- ANNUAL EARNINGS OF HS GRADUATES (F)
	- HSEM (N)	- ANNUAL EARNINGS OF HS GRADUATES (M)
$T(x)$	- TAXS (P)	- INCOME TAX RATE

$\delta$  - DELT (1) - INFLATION FACTOR  $1 + \delta$   
 $r$  - DISC (1) - DISCOUNT RATE  
 $r^1$  - INT - INTERNAL RATE OF RETURN (see R/R p.D-3)

Subscripts:

$i$  - L - Occupation  
 $j$  - N - Age  
 $k$  - I - Program  
 $m$  - M - Level of Education  
 $h$  - R - Calendar year

Superscripts

$c$  - - Year for which the analysis is undertaken  
 $o$  - - Year in which the data were published  
 $t$  - Year in which the graduation occurred

The discussion of the particular variables and subscripts is organized in alphabetic order with regard to four character mnemonics, regardless of sex (if applicable).

DELT (1)

In this phase of study set up at 1.

However, one would not expect the inflation factor that adjusts employment income of engineers, say, age 25 - 34 from 1961 to 1968 dollars to be the same factor as that of 35 - 44 or 45 - 54, or 55 - 64 year old engineers. In fact, if the earnings of engineers in the 1961 census and in the 1967 survey are used it is seen that the factor varies from 1.29 to 1.59. This variation reflects changes in supply and demand in the economy. (See Table D-1)

DIEM (N)

DIEF (N)

Life tables for Ontario 1960-1962 (F-20) have been used in this phase of the study. As stated in the introduction, standard actuarial notation is used; that is,  $p_x$  is the probability of surviving till the next age interval for a person who has attained age  $x$ . There are two tables: one for males (Table D-2) and one for females (Table D-3). The rates as stated, however, are not occupationally specific.

TOTAL ANNUAL INCOME FROM EMPLOYMENT - CANADA  
(Professional Engineers, University Graduates - Males)

TABLE D-1

Years after Professional Certification	Age	DBS Census 1961	M & I Survey 1967	Index 1967/1961
0-9	25-34	6,858	10,936	1.59
10-19	35-44	9,040	12,695	1.40
20-29	45-54	9,976	12,822	1.29
30-39	55-64	10,648	14,999	1.41

Sources: F-28 1961 Census of Canada, Table B6-8, Cat. No. 98-502  
Volume IV, DBS, 1965.

F-31 Estimates of Highly Qualified Manpower working  
for Employers and Residing in Canada, Annual  
Earnings, Tables 55B & 36. Department of Manpower  
and Immigration, 1967, (Unpublished).

To inflate the statistics reported for employment income one would like to have employment income indices, by occupation, sex and age. Also to convert data from Canadian to Ontario Statistics, a set of indices for each of Canada and Ontario would be needed. This is exactly the same problem as it is the one associated with the FRGO (I,J) variable. For more details see p. B-21.

In order to make these particular conversions, 68/67 and Ontario/Canada, we can use both the composite inflator and/or the data as provided by TABLE B-4, therefore

$$i_{68/61} = \frac{\bar{W}_{68}^O}{\bar{W}_{61}^C} = \frac{113.52}{78.24} = 1.45$$

and as stated before (p. B-22)

$$i_{68/67} = \frac{\bar{W}_{68}^O}{\bar{W}_{67}^C} = \frac{113.52}{102.83} = 1.1$$

We emphasize that these latest indices are based on the industrial composites and could lead to an understatement of the gains of professionals.

## DIEM (N) Ontario Life Table, 1960-1962 — Table de mortalité, Ontario, 1960-1962

## MALES — SEXE MASCULIN

## TABLE D-2

Age x	$l_x$	$d_x$	$p_x$	$q_x$	$L_x$	$T_x$	$^o e_x$
0	100,000	2,598	.97402	.02598	97,667	6,831,935	68.32
1	97,402	143	.99853	.00147	97,313	6,734,268	69.14
2	97,259	107	.99890	.00110	97,203	6,636,955	68.24
3	97,152	90	.99907	.00093	97,105	6,539,752	67.31
4	97,062	63	.99935	.00065	97,028	6,442,647	66.38
5	96,999	52	.99946	.00054	96,973	6,345,619	65.42
6	96,947	50	.99948	.00052	96,922	6,248,646	64.45
7	96,897	51	.99947	.00053	96,871	6,151,724	63.49
8	96,846	46	.99952	.00048	96,823	6,054,853	62.52
9	96,800	44	.99955	.00045	96,778	5,958,030	61.55
10	96,756	44	.99955	.00045	96,734	5,861,252	60.58
11	96,712	46	.99952	.00048	96,689	5,764,518	59.60
12	96,666	49	.99949	.00051	96,641	5,667,829	58.63
13	96,617	57	.99941	.00059	96,588	5,571,188	57.66
14	96,560	69	.99929	.00071	96,525	5,474,600	56.70
15	96,491	81	.99916	.00084	96,450	5,378,075	55.74
16	96,410	94	.99902	.00098	96,363	5,281,625	54.78
17	96,316	106	.99890	.00110	96,263	5,185,262	53.84
18	96,210	116	.99879	.00121	96,152	5,088,999	52.89
19	96,094	127	.99868	.00132	96,030	4,992,847	51.96
20	95,967	137	.99857	.00143	95,898	4,896,817	51.03
21	95,830	145	.99849	.00151	95,757	4,800,919	50.10
22	95,685	149	.99844	.00156	95,610	4,705,162	49.17
23	95,536	148	.99845	.00155	95,462	4,609,552	48.25
24	95,388	143	.99850	.00150	95,316	4,514,090	47.32
25	95,245	137	.99856	.00144	95,176	4,418,774	46.39
26	95,108	130	.99863	.00137	95,043	4,323,598	45.46
27	94,978	127	.99866	.00134	94,914	4,228,555	44.52
28	94,851	126	.99867	.00133	94,788	4,133,641	43.58
29	94,725	125	.99868	.00132	94,662	4,038,853	42.64
30	94,600	126	.99867	.00133	94,537	3,944,191	41.69
31	94,474	129	.99863	.00137	94,409	3,849,654	40.75
32	94,345	135	.99857	.00143	94,277	3,755,245	39.80
33	94,210	143	.99848	.00152	94,138	3,660,968	38.86
34	94,067	154	.99836	.00164	93,990	3,566,830	37.92
35	93,913	168	.99821	.00179	93,829	3,472,840	36.98
36	93,745	183	.99805	.00195	93,653	3,379,011	36.04
37	93,562	198	.99788	.00212	93,463	3,285,358	35.11
38	93,364	214	.99771	.00229	93,257	3,191,895	34.19
39	93,150	229	.99754	.00246	93,035	3,098,638	33.27
40	92,921	246	.99735	.00265	92,798	3,005,603	32.35
41	92,675	269	.99710	.00290	92,540	2,912,805	31.43
42	92,406	298	.99677	.00323	92,257	2,820,265	30.52
43	92,108	337	.99634	.00366	91,939	2,728,008	29.62
44	91,771	383	.99583	.00417	91,579	2,636,069	28.72
45	91,388	432	.99527	.00473	91,172	2,544,490	27.84
46	90,956	487	.99465	.00535	90,712	2,453,318	26.97
47	90,469	543	.99400	.00600	90,197	2,362,606	26.12
48	89,926	600	.99333	.00667	89,626	2,272,409	25.27
49	89,326	657	.99264	.00736	88,997	2,182,783	24.44
50	88,669	718	.99190	.00810	88,310	2,093,786	23.61
51	87,951	785	.99107	.00893	87,558	2,005,476	22.80
52	87,166	862	.99011	.00989	86,735	1,917,918	22.00
53	86,304	947	.98903	.01097	85,830	1,831,183	21.22
54	85,357	1,036	.98786	.01214	84,839	1,745,353	20.45

## DIEM (N) Ontario Life Table, 1960-1962 — Table de mortalité, Ontario, 1960-1962

## MALES — SEXE MASCULIN

TABLE D-2(cont'd)

Age x	$l_x$	$d_x$	$p_x$	$q_x$	$L_x$	$T_x$	$^o e_x$
55	84,321	1,131	.98659	.01341	83,755	1,660,514	19.69
56	83,190	1,231	.98520	.01480	82,574	1,576,759	18.95
57	81,959	1,337	.98369	.01631	81,290	1,494,185	18.23
58	80,622	1,448	.98204	.01796	79,898	1,412,895	17.52
59	79,174	1,562	.98027	.01973	78,393	1,332,997	16.84
60	77,612	1,677	.97839	.02161	76,773	1,254,604	16.17
61	75,935	1,791	.97641	.02359	75,039	1,177,831	15.51
62	74,144	1,903	.97433	.02567	73,192	1,102,792	14.87
63	72,241	2,005	.97225	.02775	71,238	1,029,600	14.25
64	70,236	2,097	.97015	.02985	69,187	958,362	13.64
65	68,139	2,187	.96791	.03209	67,045	889,175	13.05
66	65,952	2,281	.96542	.03458	64,811	822,130	12.47
67	63,671	2,386	.96253	.03747	62,478	757,319	11.89
68	61,285	2,495	.95929	.04071	60,037	694,841	11.34
69	58,790	2,601	.95575	.04425	57,489	634,804	10.80
70	56,189	2,702	.95191	.04809	54,838	577,315	10.27
71	53,487	2,796	.94773	.05227	52,089	522,477	9.77
72	50,691	2,880	.94318	.05682	49,251	470,388	9.28
73	47,811	2,948	.93834	.06166	46,337	421,137	8.81
74	44,863	2,996	.93321	.06679	43,365	374,800	8.35
75	41,867	3,027	.92770	.07230	40,353	331,435	7.92
76	38,840	3,040	.92172	.07828	37,320	291,082	7.49
77	35,800	3,037	.91517	.08483	34,281	253,762	7.09
78	32,763	3,011	.90810	.09190	31,257	219,481	6.70
79	29,752	2,957	.90060	.09940	28,273	188,224	6.33
80	26,795	2,879	.89255	.10745	25,355	159,951	5.97
81	23,916	2,777	.88387	.11613	22,527	134,596	5.63
82	21,139	2,654	.87446	.12554	19,812	112,069	5.30
83	18,485	2,507	.86438	.13562	17,231	92,257	4.99
84	15,978	2,338	.85369	.14631	14,809	75,026	4.70
85	13,640	2,151	.84230	.15770	12,564	60,217	4.41
86	11,489	1,952	.83012	.16988	10,513	47,653	4.15
87	9,537	1,745	.81704	.18296	8,664	37,140	3.89
88	7,792	1,534	.80313	.19687	7,025	28,476	3.65
89	6,258	1,324	.78845	.21155	5,596	21,451	3.43
90	4,934	1,120	.77292	.22708	4,374	15,855	3.21
91	3,814	929	.75643	.24357	3,349	11,481	3.01
92	2,885	753	.73888	.26112	2,508	8,132	2.82
93	2,132	596	.72034	.27966	1,834	5,624	2.64
94	1,536	459	.70088	.29912	1,306	3,790	2.47
95	1,077	344	.68039	.31961	905	2,484	2.31
96	733	250	.65878	.34122	608	1,579	2.15
97	483	176	.63596	.36404	395	971	2.01
98	307	119	.61199	.38801	247	576	1.88
99	188	78	.58693	.41307	149	329	1.75
100	110	48	.56068	.43932	86	180	1.64
101	62	29	.53316	.46684	47	94	1.52
102	33	16	.50426	.49574	25	47	1.42
103	17	9	.47405	.52595	12	22	1.29
104	8	4	.44259	.55741	6	10	1.25
105	4	2	.40978	.59022	3	4	1.00
106	2	1	.37554	.62446	1	1	0.50
107	1	1	.33975	.66025	—	—	—

## DIEF (N) Ontario Life Table, 1960-1962 - Table de mortalité, Ontario, 1960-1962

## FEMALES - SEXE FÉMININ

TABLE D-3

Age x	$l_x$	$d_x$	$p_x$	$q_x$	$L_x$	$T_x$	$^o e_x$
0	100,000	2,047	.97953	.02047	98,180	7,439,541	74.40
1	97,953	123	.99874	.00126	97,876	7,341,361	74.95
2	97,830	80	.99918	.00082	97,788	7,243,485	74.04
3	97,750	65	.99933	.00067	97,716	7,145,697	73.10
4	97,685	52	.99947	.00053	97,658	7,047,981	72.15
5	97,633	44	.99955	.00045	97,611	6,950,323	71.19
6	97,589	39	.99960	.00040	97,569	6,852,712	70.22
7	97,550	35	.99964	.00036	97,532	6,755,143	69.26
8	97,515	31	.99968	.00032	97,499	6,657,611	68.27
9	97,484	28	.99971	.00029	97,470	6,560,112	67.29
10	97,456	26	.99973	.00027	97,443	6,462,642	66.31
11	97,430	26	.99973	.00027	97,417	6,365,199	65.33
12	97,404	27	.99972	.00028	97,390	6,267,782	64.35
13	97,377	28	.99971	.00029	97,363	6,170,392	63.37
14	97,349	31	.99968	.00032	97,333	6,073,029	62.38
15	97,318	35	.99964	.00036	97,300	5,975,696	61.40
16	97,283	38	.99958	.00042	97,264	5,878,396	60.42
17	97,245	41	.99958	.00042	97,224	5,781,132	59.45
18	97,204	43	.99956	.00044	97,182	5,683,908	58.47
19	97,161	45	.99954	.00046	97,138	5,586,726	57.50
20	97,116	46	.99953	.00047	97,093	5,489,588	56.53
21	97,070	48	.99951	.00049	97,046	5,392,495	55.55
22	97,022	49	.99949	.00051	96,997	5,295,449	54.58
23	96,973	52	.99946	.00054	96,947	5,198,452	53.61
24	96,921	55	.99943	.00057	96,893	5,101,505	52.64
25	96,866	58	.99940	.00060	96,837	5,004,612	51.67
26	96,808	62	.99936	.00064	96,777	4,907,775	50.70
27	96,746	65	.99933	.00067	96,713	4,810,998	49.73
28	96,681	68	.99930	.00070	96,647	4,714,285	48.75
29	96,613	70	.99928	.00072	96,578	4,617,638	47.80
30	96,543	72	.99925	.00075	96,507	4,521,060	46.83
31	96,471	76	.99921	.00079	96,433	4,424,553	45.86
32	96,395	81	.99916	.00084	96,354	4,328,120	44.90
33	96,314	87	.99910	.00090	96,270	4,231,766	43.94
34	96,227	93	.99903	.00097	96,180	4,135,496	42.98
35	96,134	102	.99894	.00106	96,083	4,039,316	42.02
36	96,032	110	.99885	.00115	95,977	3,943,233	41.05
37	95,922	122	.99873	.00127	95,861	3,847,256	40.11
38	95,800	134	.99860	.00140	95,733	3,751,395	39.16
39	95,666	147	.99846	.00154	95,592	3,655,662	38.21
40	95,519	162	.99830	.00170	95,438	3,560,070	37.27
41	95,357	179	.99812	.00188	95,267	3,464,632	36.33
42	95,178	199	.99791	.00209	95,078	3,369,365	35.40
43	94,979	220	.99768	.00232	94,869	3,274,287	34.47
44	94,759	244	.99743	.00257	94,637	3,179,418	33.55
45	94,515	268	.99716	.00284	94,381	3,084,781	32.64
46	94,247	296	.99686	.00314	94,099	2,990,400	31.73
47	93,951	324	.99655	.00345	93,789	2,896,301	30.83
48	93,627	354	.99622	.00378	93,450	2,802,512	29.93
49	93,273	384	.99588	.00412	93,081	2,709,062	29.04
50	92,889	417	.99551	.00449	92,680	2,615,981	28.16
51	92,472	451	.99512	.00488	92,246	2,523,301	27.29
52	92,021	490	.99468	.00532	91,776	2,431,055	26.42
53	91,531	529	.99422	.00578	91,266	2,339,279	25.56
54	91,002	569	.99375	.00625	90,717	2,248,013	24.70

## DIEF (N) Ontario Life Table, 1960-1962 — Table de mortalité, Ontario, 1960-1962

## FEMALES — SEXE FEMININ

TABLE D-3(cont'd)

Age x	$l_x$	$d_x$	$p_x$	$q_x$	$L_x$	$T_x$	$^o e_x$
55	90,433	612	.99323	.00677	90,127	2,157,296	23.86
56	89,821	661	.99264	.00736	89,490	2,067,169	23.01
57	89,160	719	.99194	.00806	88,800	1,977,679	22.18
58	88,441	781	.99117	.00883	88,050	1,888,879	21.36
59	87,660	848	.99033	.00967	87,236	1,800,829	20.54
60	86,812	920	.98940	.01060	86,352	1,713,593	19.74
61	85,892	1,002	.98833	.01167	85,391	1,627,241	18.95
62	84,890	1,096	.98709	.01291	84,342	1,541,850	18.16
63	83,794	1,199	.98569	.01431	83,194	1,457,508	17.39
64	82,595	1,308	.98416	.01584	81,941	1,374,314	16.64
65	81,287	1,425	.98247	.01753	80,574	1,292,373	15.90
66	79,862	1,549	.98061	.01939	79,087	1,211,799	15.17
67	78,313	1,677	.97858	.02142	77,474	1,132,712	14.46
68	76,636	1,802	.97649	.02351	75,735	1,055,238	13.77
69	74,834	1,919	.97436	.02564	73,874	979,503	13.09
70	72,915	2,042	.97200	.02800	71,894	905,629	12.42
71	70,873	2,182	.96921	.03079	69,782	833,735	11.76
72	68,691	2,350	.96579	.03421	67,516	763,953	11.12
73	66,341	2,533	.96182	.03818	65,074	696,437	10.50
74	63,808	2,717	.95742	.04258	62,449	631,363	9.89
75	61,091	2,902	.95250	.04750	59,640	568,914	9.31
76	58,189	3,088	.94694	.05306	56,645	509,274	8.75
77	55,101	3,270	.94065	.05935	53,466	452,629	8.21
78	51,831	3,436	.93371	.06629	50,113	399,163	7.70
79	48,395	3,573	.92616	.07384	46,608	349,050	7.21
80	44,822	3,679	.91792	.08208	42,982	302,442	6.75
81	41,143	3,749	.90888	.09112	39,268	259,460	6.31
82	37,394	3,779	.89894	.10106	35,504	220,192	5.89
83	33,615	3,759	.88817	.11183	31,735	184,688	5.49
84	29,856	3,683	.87663	.12337	28,014	152,953	5.12
85	26,173	3,554	.86423	.13577	24,396	124,939	4.77
86	22,619	3,373	.85086	.14914	20,932	100,543	4.45
87	19,246	3,148	.83642	.16358	17,672	79,611	4.14
88	16,098	2,882	.82099	.17901	14,657	61,939	3.85
89	13,216	2,582	.80462	.19538	11,925	47,282	3.58
90	10,634	2,263	.78721	.21279	9,502	35,357	3.32
91	8,371	1,936	.76867	.23133	7,403	25,855	3.09
92	6,435	1,616	.74889	.25111	5,627	18,452	2.87
93	4,819	1,311	.72795	.27205	4,163	12,825	2.66
94	3,508	1,032	.70590	.29410	2,992	8,662	2.47
95	2,476	786	.68265	.31735	2,083	5,670	2.29
96	1,690	578	.65809	.34191	1,401	3,587	2.12
97	1,112	409	.63213	.36787	907	2,186	1.97
98	703	278	.60483	.39517	564	1,279	1.82
99	425	180	.57626	.42374	335	715	1.68
100	245	111	.54631	.45369	189	380	1.55
101	134	65	.51490	.48510	101	191	1.43
102	69	36	.48190	.51810	51	90	1.30
103	33	18	.44741	.55259	24	39	1.18
104	15	9	.41147	.58853	10	15	1.00
105	6	4	.37399	.62601	4	5	0.83
106	2	1	.33487	.66513	1	1	0.50
107	1	1	.29401	.70599	—	—	—

DISC (1)

This is the rate at which future returns are discounted in a calculation designed to formulate the present value of a stream of returns (or costs) over time. In this study DISC (1) = .07. For more details see B/C<sub>k</sub> p. D-2.

EARN (I,N)

GIRL (I,N)

(1) Classification of Occupations

Eighteen lifetime earnings profiles were computed for Phase one; sixteen professionals, the one catch-all of non-professionals.

In the former are included agriculture, architecture, dentistry, engineering, forestry, journalism, law, library science, medicine (pre-medicine, medical internship and residence), nursing (which includes the diploma in public health nursing), pharmacy, physical and occupational therapy, social work, veterinary medicine, theology, and teaching.

In the non-professional classification are included arts (general and first year honours), arts (upper year honours), commerce and business administration, fine and applied arts, household and food science, hygiene and public health, music, physical and health education, secretarial science (general and first year honours), science (upper year honours) child study, geography, hospital administration, dental hygiene, humanities, mathematics, physical and biological sciences, psychology, public administration, social sciences, other, technology, preliminary year and technical courses. For all of these, it is not possible to infer the individual's educational background.

Ideally one would like to know the earnings by occupation, and work function, and the educational background of all individuals. The Department of Manpower and Immigration Survey of Professional, Scientific and Technical Manpower - 1967 Selected Tabulations (F-31) lists earnings of highly qualified manpower by field of employment since either professional certification, bachelor or first professional degree, masters, or doctorate. For several occupations this is insufficient for two reasons.

- (i) The first is that one does not know the earnings by work function. That is, should one impute the earnings of a professional engineer to his formal engineering education if the individual is presently employed as a sales manager? Secondly, can it be said that the lifetime earnings profile of an economist be attributed to the educational background of economics? For the first problem one would also want to know the probability of an individual entering management after a given number of year having graduated with a B.A.Sc., given that he was in the program of engineering in a given institution. This would imply that rather than using  $P_{im:jk}$  we use  $P_{im:jk}$  as the output relevant to earnings of an individual who changed his work function after a given number of years. As it is not possible to quantify  $P_{im:jk}$  at this phase of the study, all the earnings of all engineers, despite their work function, will be applied to the educational background of engineering.
- (ii) The second obstacle cannot be so readily wished away. Even a cursory look at the educational backgrounds of economists, of managers, etc. highlights the fallacy of imputing the study of economics, commerce and business administration, etc. as the educational background of these occupations. The economist studied mathematics or engineering or commerce and business administration or general arts, etc., over and above, the obvious field of economics. Consequently the ranks of non-professionals swell while the individual professional classifications fall.

## (2) Data Available

F-28 1961 Census of Canada, Population Sample, Incomes of Individuals, (Classification by occupation, class of workers, etc.) Cat. No. 98-502, Volume IV, DBS, 1965.

Table B4 - Total income from employment by size for the non-farm MALE population 15 years of age and over, in the current

labour force, by OCCUPATION, total labour force and self employed labour force, for CANADA, for the year ended May 31, 1961, AVERAGE EMPLOYMENT INCOME.

Table B5 - Ditto for FEMALE population

Table B6 - Total income from employment by size for the non-farm MALE population 25-64 years of age, in the current labour force, by OCCUPATION, SCHOOLING and AGE, for CANADA, for the year ended May 31, 1961.

F-30 Starting Salaries for University Graduates, Reprint Table: 1965 University Graduates, Professional and Technical Occupation Section, Series A, Volume 1, Department of Manpower and Immigration, August, 1967.

F-31 Estimates of Highly Qualified Manpower working for Employers and Residing in Canada, Annual Earnings, Table 36, Department of Manpower and Immigration, 1967, (Unpublished).

### (3) Earnings of Non-Professionals

The computation of a non-professional lifetime earnings profile uses data from (F-28). From total lifetime employment income of all occupations (as in F-28/B4-1, line 1) was deducted total lifetime employment income of professionals. This yields total lifetime employment income of non-professionals. To find the average lifetime employment income of non-professionals requires a division by the number of non-professionals (this number is computed by subtracting the number of professionals from the number of reportees in the all occupation class.) See Table D-4.

It must be stated that although certain professional profiles are computed using F-31 (1967 data), the 1961 data must be used for the same groups to arrive at a non-professional profile.

Using just 1961 data does suggest an inconsistency with our data. To the extent that the 1961 data inflated to 1968 data differs with (F-31), this implication is true. Hopefully, the difference will be negligible. In any case, 1961 data were used to arrive at non-professional earnings. The next stage was to compute the ratio of lifetime employment income of non-professionals to lifetime employment income of all occupations. This value (0.96) is then multiplied by employment income of all occupations with a university degree by age (as

TOTAL ANNUAL INCOME FROM EMPLOYMENT, MALES, CANADA, 1961

TABLE D-4

OCCUPATION	NUMBER REPORTING	AVERAGE INCOME	TOTAL INCOME
All Occupations	3,824,447	4,178	15,978,539,566
Agriculture	3,854	5,911.4	22,782,633
Architecture	2,536	8,880	23,407,680
Dentistry	5,130	12,690	65,099,700
Engineering	41,779	7,637	319,066,233
Forestry	8,365	2,938.7	24,582,175
Journalism	3,159	6,263	19,784,817
Law	11,495	11,310	130,008,450
Library Science	521	4,936	2,571,656
Medicine; Pre-Medical Medical Intern & Residence	18,106	15,083	273,092,798
Nursing; Dipl. Public Health	2,148	3,728	8,007,744
Pharmacy	6,404	7,127	45,641,308
Physical and Occupational Therapy	641	4,597	2,946,677
Social Work	4,732	4,200	19,874,400
Veterinary Medicine	1,407	8,577	12,067,839
Theology	15,076	3,200	48,243,200
Teachers (just school teachers)	43,532	5,885	256,185,820
TOTAL PROFESSIONAL	168,985	-	1,273,363,120
TOTAL NON-PROFESSIONAL	3,655,462	4,022	14,705,176,446

Source: F-28/B4

in F-28/B6-1) to arrive at an imputed value for employment income of non-professionals by age. The last adjustment is the multiplication of those values by the composite inflator 68/61 & O/C (1.45 - See p.D-4.1). Thus we have obtained the Tables D-6 and D-7 (for I = 1,2,4,5,7,10,11,12,13,15,16,18,19,20,21, 57,58).

The described procedure assumes

$$\frac{\text{Average income of all occupations by age}}{\text{Average lifetime income of all occupations}} =$$

$$\frac{\text{Average income of non-professionals by age}}{\text{Average lifetime income of all non-professionals}}$$

It might be argued that the non-professional earnings by imputed solely from (F-28/B6). Although the procedure would be as above, the calculations are more laborious.

#### (4) Earnings of Professionals

The tables D-6 and D-7 (for I=1,2,4,5,7,10,11,12,13, 15,16,18,19,20,21,57,58) were computed from F-21/B6 and by means of three ratios to transform data into a form which might be used:

- i) converts earnings of individuals working for employers to earnings of all employed  
source: F-31/36 (1967)

$$\frac{\text{all employed}}{\text{working for an employer}}$$

- ii) disaggregates a broad category of occupations into specific occupations for MALES  
Source: F-28/B4 (1961) - average employment income

$$\frac{\text{specific occupation (male)}}{\text{category (male)}}$$

- iii) disaggregates a broad category of occupations into specific occupations and adjusts it simultaneously for FEMALES  
Source: F-28/B5, B4 (1961) - average employment income

$$\frac{\text{specific occupation (female)}}{\text{category (male)}}$$

TABLE D-5

OCCUPATION	RATIO (i)				RATIO (ii)			RATIO (iii)	
	F-31/36		2:3	F-28/B4	F-28/B5	5:6	F-28/B5 SPECIFIC	8:6	8
	ALL	EMPLOYER							
1	2	3	4	5	6	7	8	9	
Agriculture	9905	9837	1.00	5911	6624	0.81	3834	0.58	
Architecture	14219	10859	1.31			*		**	
Dentistry			*			*		**	
Engineering	12472	12748	1.03			*		**	
Forestry	11516	11439	1.01			*		**	
Journalism			*	6263	5591	1.12	3156	0.56	
Lawyers and Notaries			*		11310	*	4589	0.41	
Library Science			*	4936	5408	0.91	3446	0.64	
Medicine			*		10943	*	5732	**	
Nursing			*	3728	10943	0.34	2711	0.25	
Pharmacy			*	7127	10943	0.65	3550	0.32	
Physical & Occup. Therapy			*	4597	10943	0.42	2859	0.26	
Social Work	8637	8639	1.00			*		**	
Veterinary Medicine	11945	10600	1.13			*		**	
Theology			*		3200	*	1694	0.53	
Teachers			*			*		**	

\* No disaggregation necessary

\*\* No adjustment made as earnings of females relative to males currently more equitable than 1961. If wage indices by sex were available this imprecision would not be necessary.

EARN(I,N)

LIFETIME EARNING PROFILE - MALES - ONTARIO, 1968

TABLE D-6

I \ N	AGE				
	22	30	40	50	60
01	6891	8619	10673	10047	9751
02	7306	11443	17154	16871	18828
03	(8578)	9618	13872	15063	14768
04	9270	20336	21657	20973	15689
05	7306	9470	13360	15361	16557
06	(8578)	9618	13872	15063	14768
07	7099	9014	12497	12829	17465
08	(8578)	9618	13872	15063	14768
09	(8578)	9618	13872	15063	14768
10	5876	8272	12299	13004	13004
11	6922	11425	19250	19881	23667
12	6551	8159	11062	12305	13785
13	(10000)	13646	26605	28606	22537
14	(8578)	9618	13872	15063	14768
15	5438	5438	7832	8210	6302
16	8405	8828	14629	15351	11703
17	(8578)	9618	13872	15063	14768
18	5562	5704	9453	9919	7562
19	6674	7757	9273	9622	8939
20	(8000)	10641	13839	13684	12935
21	(4000)	4450	5124	5475	5845
22	(8578)	9618	13872	15063	14768
23	"	"	"	"	"
24	"	"	"	"	"
25	"	"	"	"	"
26	"	"	"	"	"
27	"	"	"	"	"
28	"	"	"	"	"
29	"	"	"	"	"
30	"	"	"	"	"
31	"	"	"	"	"
32	"	"	"	"	"
33	"	"	"	"	"
34	"	"	"	"	"
35	"	"	"	"	"
36	"	"	"	"	"
37	"	"	"	"	"
38	"	"	"	"	"
39	"	"	"	"	"

I \ N	AGE				
	22	30	40	50	60
40	(8578)	9618	13872	15063	14768
41	"	"	"	"	"
42	"	"	"	"	"
43	"	"	"	"	"
44	"	"	"	"	"
45	"	"	"	"	"
46	"	"	"	"	"
47	"	"	"	"	"
48	"	"	"	"	"
49	"	"	"	"	"
50	"	"	"	"	"
51	"	"	"	"	"
52	"	"	"	"	"
53	"	"	"	"	"
54	"	"	"	"	"
55	"	"	"	"	"
56	(8578)	9618	13872	15063	14768
57	6798	8590	10829	12528	13107
58	6798	6798	10829	12528	13107
59	-	-	-	-	-
60	-	-	-	-	-
61	-	-	-	-	-
62	(8578)	9618	13872	15063	14768
63	"	"	"	"	"
64	"	"	"	"	"
65	"	"	"	"	"
66	"	"	"	"	"
67	"	"	"	"	"
68	"	"	"	"	"
69	"	"	"	"	"
70	"	"	"	"	"
71	"	"	"	"	"
72	"	"	"	"	"
73	"	"	"	"	"
74	"	"	"	"	"
75	"	"	"	"	"
76	"	"	"	"	"
77	"	"	"	"	"

Source: F-28/B4,B6 (N = 30,40,50,60)  
F-30 (N = 22)

The bracketed figures are set at the indicated values in order to enable the smooth polynomial fitting of the income function.

## GIRL(I,N) LIFETIME EARNING PROFITL - FEMALES - ONTARIO, 1968

TABLE D-7

I	AGE				
	22	30	40	50	60
01	4960	5617	6956	6547	6354
02	7306	11443	17154	16871	18828
03	(5000)	5184	7475	8119	7960
04	9270	20336	21657	20973	15689
05	7306	9470	13360	15361	16557
06	(5000)	5184	7475	8119	7960
07	7099	9014	12497	12829	17465
08	(5000)	5184	7475	8119	7950
09	(5000)	5184	7475	8119	7960
10	2939	3551	4502	4760	4760
11	2838	4683	7892	8152	9703
12	4586	5738	7779	8654	9695
13	(10000)	13646	26605	28606	22537
14	(5000)	5184	7475	8119	7960
15	4024	4024	5807	6084	4681
16	4118	4346	7202	7557	5761
17	(5000)	5184	7475	8119	7960
18	3448	3531	5852	6141	4681
19	6674	7757	9273	9622	8939
20	(8000)	10641	13839	13684	12935
21	(2100)	2379	2643	2901	3084
22	(5000)	5184	7475	8119	7960
23	"	"	"	"	"
24	"	"	"	"	"
25	"	"	"	"	"
26	"	"	"	"	"
27	"	"	"	"	"
28	"	"	"	"	"
29	"	"	"	"	"
30	"	"	"	"	"
31	"	"	"	"	"
32	"	"	"	"	"
33	"	"	"	"	"
34	"	"	"	"	"
35	"	"	"	"	"
36	"	"	"	"	"
37	"	"	"	"	"
38	"	"	"	"	"
39	"	"	"	"	"

I	AGE				
	22	30	40	50	60
40	(5000)	5184	7475	8119	7960
41	"	"	"	"	"
42	"	"	"	"	"
43	"	"	"	"	"
44	"	"	"	"	"
45	"	"	"	"	"
46	"	"	"	"	"
47	"	"	"	"	"
48	"	"	"	"	"
49	"	"	"	"	"
50	"	"	"	"	"
51	"	"	"	"	"
52	"	"	"	"	"
53	"	"	"	"	"
54	"	"	"	"	"
55	"	"	"	"	"
56	(5000)	5184	7475	8119	7960
57	6798	8590	10829	12528	13107
58	6798	8590	10829	13528	13107
59	-	-	-	-	-
60	-	-	-	-	-
61	-	-	-	-	-
62	(5000)	5184	7475	8119	7960
63	"	"	"	"	"
64	"	"	"	"	"
65	"	"	"	"	"
66	"	"	"	"	"
67	"	"	"	"	"
68	"	"	"	"	"
69	"	"	"	"	"
70	"	"	"	"	"
71	"	"	"	"	"
72	"	"	"	"	"
73	"	"	"	"	"
74	"	"	"	"	"
75	"	"	"	"	"
76	"	"	"	"	"
77	"	"	"	"	"

Sources: F-28/B<sup>5</sup>,B<sup>6</sup> (N = 30,40,50,60)  
 F-30 (N = 22)

The bracketed figures are set at the indicated values in order to enable the smooth polynomial fitting of the income function.

## (5) Notes

### Female Earnings

It seems unreasonable to scale down the earnings of females for certain professions. For example, according to the weighing factors, female physicians and surgeons should earn 52% of their male counterparts. It would be possible to deflate the female earnings in this fashion if wage indices were available for males and females by occupation. If this were so, then the higher female index would tend to bring the two profiles, (i.e. male and female) closer to parity. This is not the case. As such, the following professions report equal earning profiles for both male and female: architecture, dentistry, engineering, forestry, social work, veterinary medicine.

### Female Starting Salaries

Where the female earnings were scaled down, the starting salary was also scaled down by the same factor. This is not accurate. The female - male earnings ratio of 1961 is not the same as the female - male ratio of 1968. As the ratio by occupation for 1968 was not available, the 1961 ratio was used.

### Starting Salaries and Special Cases

In the case of medicine and theology, the starting salary is presumably at or after age 25. As a result no starting salary was reported. For veterinary medicine and Teachers' College graduates, no starting salaries were published in the 1968 Manpower and Immigration Statistics. For these two entries, estimates were used.

The \$6,690 starting salary is a straight average of \$550 per month for general bachelors and \$565 for honours bachelors.

The engineering starting salary is an average of 11 forms of engineering: chemical, civil, electrical, forestry, geological, geophysical, industrial, mechanical, mining physics, and surveying. As the number of people reporting in each branch is not published, the \$7,380 is a straight average. The rest of the profile of engineers is a weighted average by the number reporting - of an exhaustive set of the different types of engineering: aeronautical, ceramic, chemical, civil, electrical (electronics and power), geological, industrial, marine, materials, mechanical, metallurgical, mining, nuclear, petroleum, surveying, textile, transportation, and a catch-all of engineering not elsewhere specified.

The figure for lawyers is not representative of the articling year. Articlers received, in fact, \$3,720 in 1968. For nurses (male) the \$5,280 figure is for nurses with a degree plus R.N. There are currently (1970) 47 hospitals on the 2 + 1 system. According to this set-up, students are given room and board for the first two years, and \$375 per month in the third year. For 1968, \$5,280 will be used rather than \$3,900 as the starting salary. The "2 + 1" system is to be replaced by the two year system, which, like the university, has no payments.

A further difficulty with the 1961 data is that it includes lower paid non-resident nurses. Hence the figure, after inflation to 1968, should be raised. As Registered Nurses make \$30 more per month, an even split will be assumed of reported registered and non-registered nurses in the 1961 census, and hence only \$180 will be added to the annual earnings.

The final problem is due to not accepting lower female earnings profiles for all occupations. Previously, when the female non-professional profile was determined, the male non-professional profile was multiplied by the ratio of female to male earnings of all occupations. It is clear that this ratio understates the true female earnings. As a result only an estimate of the true ratio can be made. It will be assumed that the female non-professional earnings are 110% of the calculations without this refinement.

To find the return to Post-secondary Education it is necessary to consider the expected net gain in earnings due a particular educational training. Although the earnings of high school graduates are netted out as explained in the benefit-model, the netting should be done by high school graduate earnings by occupation. That is, the journalists earnings would be the earnings of a journalist with a Post-secondary Education degree minus the earnings of a journalist without a Post-secondary Education degree. As the data for this calculation were not always available it was necessary to settle for deducting those average earnings of high school graduates for all occupations from each of the different professions and the one non-professional category.

The earnings for the agricultural professionals were gleaned from the census from the category "Biologists and Agricultural Professionals". As Veterinarians were

included in this group, they were averaged out.

Journalists are included with authors and editors under the general rubric artists, writers, musicians. The census lists no earnings for ages 55-64. This, then, must be estimated.

#### EXIT (L,N)

is a measure of net migration of Post-secondary students and/or graduates from the Province of Ontario. From the private vantage point,  $EXIT(L,N) = 1$ . This is an over-simplified assumption designed to express that the student will reap the gains from his Post-secondary Education no matter where he lives. From the societal viewpoint it might be argued that EXIT is equal to or less than one depending on whether there is a net inflow, no change, or net outflow of Post-secondary students and/or graduates from the Province of Ontario. For the time being the value of  $EXIT(L,N) = \underline{1}$ .

#### GROW (R)

As the lifetime earnings profile is being determined from cross-sectional data it seems more than reasonable to adjust for the real growth in per capita income. Furthermore, as the demand and supply conditions are constantly changing, it can be fully expected that the earnings profiles of different occupations over time will change relative to each other. As a result, the analyst, at the time of the computer run, can posit different values of this real per capita growth rate, for as many of the different occupations as he so desires. Alternatively, of course, he can assume only one rate for all occupations. The value of GROW was set at 2.7% in this phase of the study. It was estimated from the following set of data:

TABLE D-8

Year	Seasonally Adjusted G.N.E. 000,000's	Population Canada 000's	G.N.E. Per Capita 000's	Rate of Growth (%)
1	2	3	4	5
1965	44,768	19,644	2,279	-
1966	47,636	20,015	2,380	4.43
1967	49,121	20,405	2,407	1.13
1968	51,451	20,744	2,480	3.03

Source: F-15 Canada Year Book 1969, Cat. No. 11-205, DBS, 1970.

F-16 National Accounts, Income and Expenditures 1968, Cat. No. 13-201, DBS, 1969.

The growth factor should be occupation and year specific, however, the implementation of this variable in such a format implies a knowledge of market trends. Without a manpower study, future changes in supply and demand can only be guessed at. By including 2.7% as the average real growth rate, changes in earnings due productivity are accounted for.

Although the model is flexible enough to allow for changes in occupational growth rates over time, the analyst is urged to use this tool only with strong a priori hypotheses.

#### HSAB (1)

is an adjustment for the ability of the student. It is an index which discounts average earnings of an individual currently working in a particular occupation to the earnings which would be earned in that occupation by an individual of given ability. The value of HSAB has been set at 60.00

In "Measuring the Contribution of Education (and the Residual) to Economic Growth" in the Residual Factor and Economic Growth E. F. Denison (E-13) has suggested that the 'elementary-secondary' level perhaps 40% of the observed differentials in earnings are attributable to differentials in students abilities, etc. (p. 495). G. Becker (E-3) in Human Capital, attempts to isolate ability as a determinant of earnings (chapter IV). He finally suggests "... that college education itself explains most of the unadjusted differential between college and high-school graduates" (p. 88). He suggests that ability plays a greater role in education before the post-secondary experience. In "Monetary Returns to College Education, Student Ability, & College Education" B. Weisbrod and P. Karpoff (E-66) state that "... about one-fourth of the difference shown by census data between the mean earnings of college graduates and the mean earnings of high-school graduates can be viewed as a return to the higher level of non-schooling variables possessed by college students generally, and not as a return to schooling". This figure ranges from 18% to 31% depending on the reference group used.

As Denison says, "to the extent that college education is an investment in higher earnings, it appears to be a better investment for those individuals who have the ability and motivation to achieve high class rank" (p.497)

Student ability can be measured through the careful consideration of the following:

- (i) teachers' recommendations concerning the initiative, co-operation, reliability, industriousness, etc. of the students entering into Post-secondary Education.
- (ii) teachers' ratings on the chances that students will enter Post-secondary Institutions.
- (iii) teachers' ratings on the chances of students succeeding at university.
- (iv) the final high school year grade averages of the students entering into Post-secondary Education.
- (v) the results of standardized scholastic tests.

The Office of Statistics and Records, at the University of Toronto published Student Statistics Volume V, 1967-1968 (F-36). From this, are obtained the grade 13 averages of 1st year undergraduates in 1967-68 at the U. of T.

Two problems, albeit minor, are introduced here. The first is that the data is for 1967-68. This is not serious, as the results are not sensitive to small changes in standards. The second problem is that of considering the standards at the University of Toronto as a standard for Ontario. Once again, this is not serious as i) only a relative idea of the ability of students in various courses is needed. The actual level is not important. ii) The difference in the admission standards of the different schools will be partially taken up by the probability of succeeding in a given program at a given institution.

For example, if the standards at the University of Toronto in program I are higher than the same standards at different institutions, then hopefully the probability of succeeding in that program at the University of Toronto will also be somewhat higher. This will tend to give a greater relative return to graduates of the University of Toronto.

A final problem is that not all of the data needed are available. Where they are not accessible, they are estimated. Such estimates are indicated by a capital "E" (Table D-9)

A further assumption to make the model operative is to posit a value of ability for the high school graduate who does not continue into Post-secondary Education. For this, 60.0 was used as it is the minimum entrance average. Consistent with the theoretical preamble to this variable, it is assumed that "ability" is responsible for from 0 to 40 per cent of the expected net gain in earnings due Post-secondary Education. The final step then, is to subtract the ability of occupation "i" from the ability of the high school graduate and normalize. This difference times b, where  $b < 40\%$  yields the percentage of earnings due ability. The purpose of the subtraction is to form an ability index which "converts the average earnings of an individual currently working in a particular occupation to the earnings which would be earned in that occupation by an individual of greater than high school ability:

The function finally utilized may be expressed as

$$HSAB = \left[ 1 + \left( \frac{UN - 60}{60} b \right) \right]^{-1}$$

where UN = grade 13 average of university student  
(program specific)

b = ability coefficient  $0 < b < 40$

TABLE D-9

PROGRAM	UN (AVERAGE)	
Agriculture	70.0	E
Architecture	73.2	
Dentistry	73.0	E
Engineering	72.8	
Forestry	66.0	
Journalism	66.0	E
Law	73.0	E
Library	73.0	E
Medicine	81.0	
Nursing	71.6	
Pharmacy	67.6	
Physical and Occup. Therapy	70.1	
Social Work	73.0	E
Veterinary Medicine	73.0	E
Theology	70.0	E
Teaching - University - Teachers' College	68.0	
Non-Professionals	*68	E

Source : F-36

- \* the average of the faculty of Arts & Science is 72.8 (67.9 general courses, 76.4 in honour course). The non-professional category includes: Applied Arts 71.9, Food Science 58.3, Physical & Health Education 68.4, and Dental Hygiene 65.8. Then values, as well as others not published, pull the non-professional average down from 72.8.

HSCS (1)

SNOB (1)

The non-pecuniary benefit vary over occupations. This helps to explain, for example, the difference in earnings between professors and equally educated but usually better paid non-professors. Of course, monopolies, monopsonies, customs, trade unions, etc. account for differentials in earnings among the different occupations. It is not intended that be an equalizing force. In this phase of the study HSCS and/or SNOB = 0.

It has been stated earlier that there exist several ways to price the outputs of Post-secondary Education. Besides using the lifetime earnings as a pricing factor, one might use the prestige or status associated with the various outputs of Post-secondary Education. The obvious problem is the inability to measure this prestige or status.

This is not to say that the "sociological" aspects of the problem are a neglected area. However, in this phase of the study, solely the financial returns on the investment will be considered. To this extent, all returns have been understated. Certainly the average student does not consider his Post-secondary Education experience as just an investment and no doubt there is a greater non-pecuniary return in certain occupations. Perhaps various occupations offer attractive fringe benefits, either tangible or intangible that do not appear in the earnings profile. As a result, an element of flexibility has been built into the model, whereby non-pecuniary rates can be input. However, rather than posit unsubstantiated non-pecuniary returns to certain occupations, it has been assumed that non-pecuniary returns are equal to zero. This does not alter the relative attractiveness of financial returns. By understating the absolute returns to the more "non-pecuniary-attractive" occupations, the true overall relative returns have been altered.

HSEF (N)

HSEM (N)

represents the unadjusted annual earnings figures by age of high school graduates.

## HIGH SCHOOL GRADUATE EARNINGS (ANNUALLY)

Age		CANADA 1967		ONTARIO 1968	
		Males	Females	Males HSEM	Females HSEF
1	2	3	4	5	6
15-19	17	1,657	1,419	1,823	1,561
20-24	22	4,040	2,875	4,444	3,163
25-34	30	6,357	3,158	6,993	3,474
35-44	40	7,488	3,239	8,237	3,563
45-54	50	7,538	3,303	8,292	3,633
55-64	60	7,130	3,544	7,843	3,898

TABLE D-10

Source: (col. 1-4) Consumer Finance Branch, DBS

The columns 5 & 6 were computed by means of the composite inflator 68/67, Ontario/Canada (1.1). For more details see FRGO(I,J) p.21.

HSPF (N)

HSPM (N)

LABF (I,N)

LABR (I,N)

is the labour force participation rate. Future earnings must be discounted to account for non-participation in the labour force.

It is desired to have labour force data by occupation and by age for the province of Ontario. This is currently not possible. More current data can be found in the DBS's Seasonally Adjusted Labour Force Statistics (F-18) - January 1953 - December 1969. These data, however, are for Canada. It is felt that the latter are the least imprecise and hence annual averages are determined from the monthly averages given.

It is assumed that all professionals and non-professionals are in the labour force up to age 44. From 45-64 the overall rate is applied to these groups. The overall rate is also applied to high school graduates.

LABOUR FORCE PARTICIPATION RATES

TABLE D-11

VARIABLE	LEVEL	SEX	PROGRAM DIVISION	AGE			
				17-19	20-24	25-44	45-64
1	2	3	4	5	6	7	8
HSPM	HS	M	-	.391	.8425	.9706	.9105
HSPF		F		.3132	.5833	.3642	.3545
LABR	PSE	M	Profess'l	.391	1.0000	1.0000	.9105
			Non-Prof	.391	.8425	.9706	.9105
F		Profess'l	.3132	1.0000	1.0000	.3545	
		Non-Prof	.3132	.5833	.3642	.3545	

Source: F-18

TAXS (P)

is the tax rate applicable to earnings. The theory here may be formally stated as the following: when computing the private rate of return, the individual should consider only his net income when determining his private benefits. The societal benefit, however, will involve calculations with income gross of taxes in order to reflect the measure in economic growth consistent with that in the national accounts.

From the 1970 Taxation Statistics published by the taxation branch of the Department of National Revenue, it was possible to ascertain, by income classes, the total employment income earned. To do so, it was necessary to deduct certain items, such as rental income, from the "sources of income". The tax rate applicable is then the -

$$\frac{\text{tax paid on this employment income}}{\text{gross employment income}}$$

However, there was difficulty in

- 1) ascertaining the correct portion of exemptions to disallow after having reduced the total income assessed
- 2) knowing by how much to reduce the total tax paid to accord with the new lower total employment income figure.

If the argument that the relevant income data are all income, rather than income from employment is accepted, then there, of course, would be no problem. This school of thought contends that investment income is derived from employment income.

However,

- 1) inherited wealth contradicts this chain of thought
- 2) further, and of import, is the fact that if all doctors, say, invested all employment income and lost it, then all income would be zero, and our returns to the education of doctors would be biased.

To the extent that lower income classes have less income employed in investments, the data will be less biased at this end of the income spectrum. At the upper end, it will be more biased. For example, the 15,000 gross income reporter, with 1 wife and 2 children pays 21.7% if all of the income were taxable. The \$25,000 man would likewise pay 27%. The value found here, 19.3% is thus low.

Using the tax on all income, as opposed to income from employment, is inconsistent with the earnings statistics which report employment income.

It should be noted that the problem only becomes apparent when dealing with the individual. For society, all earnings are gross of tax. See Table D-12.

#### SUBSCRIPTS:

##### I (k) PROGRAM

represents the institution or program in which the individual is enrolled. The analyst is free to choose how narrowly or how broadly k is to be specified. An example might be an engineering program at a particular college. However, this study follows the pattern of D.U.A.

##### L (i) OCCUPATION

represents the different occupations,  $i = 1, 2, 3, \dots, n$ . At this stage we will distinguish two broad categories: the "professionals" and the "non-professionals". The former includes engineers, doctors, dentists, butchers,

# INCOME TAX RATES

TABLE D-12

Income Class (\$)	Tax Rate (%)	Income Class (\$)	Tax Rate
under \$1,000	0	3,900- 4,000	7.9
\$1,000-\$1,100	0	4,000- 4,100	8.15
1,100- 1,200	0	4,100- 4,200	8.25
1,200- 1,300	0	4,200- 4,300	8.5
1,300- 1,400	0	4,300- 4,400	8.5
1,400- 1,500	1.7	4,400- 4,500	8.8
1,500- 1,600	2.0	4,500- 4,600	8.8
1,600- 1,700	2.3	4,600- 4,700	8.8
1,700- 1,800	2.7	4,700- 4,800	9.1
1,800- 1,900	3.0	4,800- 4,900	9.1
1,900- 2,000	3.25	4,900- 5,000	9.4
2,000- 2,100	3.4	5,000- 5,500	9.7
2,100- 2,200	3.6	5,500- 6,000	10.3
2,200- 2,300	4.1	6,000- 6,500	10.9
2,300- 2,400	4.25	6,500- 7,000	11.4
2,400- 2,500	4.7	7,000- 7,500	12.0
2,500- 2,600	4.9	7,500- 8,000	12.5
2,600- 2,700	5.1	8,000- 8,500	12.9
2,700- 2,800	5.4	8,500- 9,000	13.3
2,800- 2,900	5.7	9,000- 9,500	13.8
2,900- 3,000	5.8	9,500-10,000	14.0
3,000- 3,100	6.1	10,000-11,000	14.5
3,100- 3,200	6.5	11,000-12,000	15.1
3,200- 3,300	6.55	12,000-15,000	16.4
3,300- 3,400	6.9	15,000-20,000	18.7
3,400- 3,500	7.1	20,000-25,000	22.0
3,500- 3,600	7.2	25,000-50,000	27.1
3,600- 3,700	7.5	50,000-100,000	34.8
3,700- 3,800	7.5	100,000-200,000	39.25
3,800- 3,900	7.7	200,000 and over	39.4

Source: F-32 Taxation Statistics, Analyzing the Returns of Individuals for the 1968 Taxation Year and Miscellaneous Statistics, Table 2, Row 23, 43, Page 16-35, Cat. Rv. 44-1970, Department of National Revenue, The Queen's Printer, Ottawa, 1970.

etc., who share the characteristic that their occupation can be directly inferred from their field of study. That is, engineers studied engineering, doctors studied medicine etc. We have attempted to estimate earnings for each of these occupations separately. The latter category includes individuals whose educational backgrounds are unrelated to their occupations. Thus we cannot assume that students in economics go on to become economists, etc.

M (m) LEVEL OF EDUCATION (See Table A-9 p. A-20)

1. refers to students graduating from high school but not attending an institution of Post-secondary Education.
2. refers to students attending an institution of Post-secondary Education but not graduating.
3. refers to students successfully completing a program of Post-secondary Education, but not continuing for further qualification from a post-secondary institution (this is the important variable)
4. refers to students successfully completing the first stage of Post-secondary Education and going on to the next stage of Post-secondary Education.

Further stages will have a more detailed disaggregation:

5. refers to students successfully completing the second stage (Masters Level) of Post-secondary Education but not continuing for the third stage
6. refers to students entering the third (Ph.D) stage of Post-secondary Education but not successfully completing this stage.
7. refers to students successfully completing the third stage of Post-secondary Education.

N (j) AGE (See Table A-10 p. A-20)

SUPERSCRIPTS:

INDX The elapsed period,  $INDX = c-o$ , where

c stands for the year which the analysis is undertaken, (1968 in this particular case)

o stands for the year which the data were published, (e.g. 1961)

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## STANDARD STATEMENT

	n a m e	source	amount
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1 I N C O M E

F-1, F-2

2	Student fees				
3	Government grants (operating)				
4	Gifts (except research & fin.aid)				
5	Receipts from service to outside				
6 *	Research (sponsored & assisted)				
7 *	Student financial aid				
8 *	Student service (residence etc.)				
9	Miscellaneous				
10	T o t a l				

11 E X P E N D I T U R E S

F-1, F-2

12 F i x e d

13	Library				
14	Research				
15	General administration				
16	Plant maintenance				
17	Major repairs and renovation				
18	Depreciation				
19	Interest (total)				
20 *	Net deficit on ancillary enterpr's				
21	Other fixed expenditures				
22	S u b t o t a l				
23	V a r i a b l e				
24	Academic - salaries				
25	- fringe benefits				
26	- other academic				
27	Student service (residence etc.)				
28	Student financial aid				
29	Miscellaneous				
30	S u b t o t a l				
31	T o t a l				
32	E x c l u s i o n s				
33	Research (sponsored & assisted)	*	6	(above)	
34	Student financial aid	*	28		
35	Student service receipts	*	8		
36	Net deficit on ancillary enterpr's	*	20		
37	S u b t o t a l				
38	T o t a l (Net Expenditures)				

**SRG**

Institution \_\_\_\_\_

Campus \_\_\_\_\_

F-71

STANDARD BALANCE SHEET

## A S S E T S

		Source	Amount			
1	Current	F-1,F-2				
2 *	Capital					
3 *	Trust and Endowment					
4	T O T A L					

## L I A B I L I T I E S

5	Current Funds					
6	Dues	F-1,F-2				
7	Operating Reserves					
8	Other					
9 *	S u b t o t a l					
10	Capital Funds	F-1,F-2				
11	Dues					
12	Long-term debt					
13	Equity in properties					
14	Other					
15	S u b t o t a l					
16	Trust & Endowment	F-1,F-2				
17	Dues					
18	Restricted					
19	Expendable					
19	S u b t o t a l					
20	T O T A L					

## C A P I T A L A S S E T S S T R U C T U R E

21	Land	F-1,F-2				
22	Buildings (21 + 22)	F-1,F-2				
23	Equipment	F-1,F-2				
24	Construction in progres	F-1,F-2				
25 *	S u b t o t a l (22+23+24)					
26	Other	F-1,F-2				
27	T O T A L	*2				

## E M P L O Y E D C A P I T A L I N E D U C A T I O N A L P R O G R A M

28	Current Funds	*1				
29	Capital Tangible Assets	*25				
30	Trust & Other Funds (minus Investments)	*3				
31	T O T A L					


 RECAPITULATION
 

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Land Category		Source	Acreage	Per cent	AVG price	Market value		
1	2	3	4	5	6	7		
1	BUILDINGS	F-6-1						
2	ATHLETIC AREAS	F-6-2						
3	PARKING FIELDS	F-6-3						
4	FARMLAND	F-6-4						
5	WATER	F-6-5						
6	OTHER OPEN SPACE	F-6-6						
7	Subtotal	-						
8	NOT OWNED BY UNIVERSITY	F-6-7						
9	AGGREGATE	F-6-8						
10	TOTAL	F-6-9						
11	Book value of the land	F-71-21						
12	Subtotal - Increment to the book value of the capital							
13	Book value of the capital	F-71-31						
14	TOTAL VALUE OF THE EMPLOYED CAPITAL							

1	2	Source	Amount		
		3	7		
15	OSAP GRANTS	F-7(15C)			
16	OSAP LOANS EXPENDITURES	F-7(15C)			
17	ONT GRAD FELOWSHIPS	F-7(16A)			
18	DIRECT STUDENT AWARDS	F-31			
19	GOVERNMENT CAPITAL GRANTS	F-5			
20	OUCAC FINANCING	F-5			
21	MORTGAGE FINANCING	F-5			
22	OTHER FINANCING	F-5			
23	CAMPAIGN & CAPITAL GIFTS	F-5			
24	INTEREST ON CAPITAL FUNDS				
25	SALES OF CAPITAL ASSETS				
26	EDUCATION HOSP. EXPEND.	F-10			
27	REPAYMENT TO OUCAC	F-5			
28	OTHER REPAYMENT	F-5			
30	DEPRECIATION	F-71-25(22+23+24)			
31	LOSS OF PROPERTY TAX	F-71-22(21+22)			







